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GRAVE, PERHAPS, RATHER THAN GAY

FOR its annual meeting this year the Institution of Gas Engineers chose Church House, Westminster. It was a wise choice and popular in the event. Founded in the Jubilee Year of Queen Victoria, the building received a direct hit from German bombs in October, 1940. Our Government thereupon decided—in spite of the fact that the Assembly Hall had been demolished—that the structure was pre-eminently suitable for occupation of both Houses of Parliament during the war. Surely a typically British decision. And among other happenings came the housing in Church House of the Wartime Crimes Commission and those who took part in the preparation of U.N.O.

The President of the Institution
J. H. Dyde, M.Sc.

And now in 1952 the gates opened to the eminent are opened also to the Institution of Gas Engineers, whose members flow in respectably and respectfully on May 27, lingering awhile, as custom demands, on the steps of some inner court or other to pray for inspiration from the presidential address, albeit with an eye to the Press photographer. We pass into the reconditioned and truly impressive Assembly Hall. We note with admiration the entry of area board chiefs through the Laity 'Noes,' the entry of gas engineers through the Church 'Noes.' There are no 'yes men' in this House. Dignity pervades. The tone of the meeting is set. There is no sign of gunpowder plot.

The President of the Institution, John Dyde, had a good, a most cordial and friendly, reception. He has put in a good deal of intelligent thought all to the benefit ultimately of the Institution. His youth and his courage have served the Institution well. For it is no joke to accept the Presidency nowadays; it demands nine years hard in the pen, and the actual twelve months of office call for just that little extra. John Dyde rose to the command. His address, an abstract of which we publish on later pages, was forceful, and particularly interesting in view of his vivid impressions of the gas industry of America following immediately his tour of the States as the leader of the British Gas Industry Productivity Team. No doubt he sifted some of his impressions before they appeared in a blue book.

And thinking of Institution blue books makes us wonder. On May 27 there was a meeting of corporate members to accept the decision of the Council to increase membership subscriptions. Legitimate bogey was rise in cost of paper and printing. We do not belittle the wisdom of Council of I.G.E., but do suggest that the costs which prove such a burden to the Institution and to readers of its *Transactions* could be eased if authors were forced to be much briefer in their accounts of investigations in which they may be interested. Some of the most telling expositions of original thought in the gas industry have been stated with a brevity combining clarity with sheer intellectual enjoyment—and stunning after-effect. Should long-winded technical authors be allowed?

Broadly, the 1952 meeting of the Institution was good, not sparkling. Stars do not shine brightly at will. The story of the meeting as we tell it in our issue today indicates the growing strength of the Institution in particular, of the British gas industry in general. It indicates, too, how, with the changed economic conditions relating to raw materials, new conceptions are being brought to bear in the solving of problems of gas manufacture and supply.

REVIEW

THE 89th annual general meeting of the Institution of Gas Engineers opened on the morning of May 27 under the presidency of Mr. J. H. DYDE, M.SC., Deputy Chairman of the Eastern Gas Board, at Church House, Westminster. The choice of the meeting place proved highly popular and exceedingly convenient —a most admirable building for the purpose, with its spacious surrounds. It may be recalled that the building received a direct hit in an air raid in October, 1940, when the assembly hall was ruined. But the solidity of the structure was such that the Government requisitioned the building and made it the official choice as an alternative meeting place for both Houses of Parliament. During the war other official organisations were in the building, including the Ministry of Aircraft Production and the War Crimes Commission. The preparatory commission for the first assembly of the United Nations Organisation also had its offices in Church House.

The first duty of the President was to welcome representatives of overseas gas associations and members present from abroad. Mr. Dyde said how honoured they were by the presence of M. J. Kec and M. A. Lihrmann, respectively the President and the General Secretary of the Association Technique de l'Industrie du Gaz en France. With equal pleasure they welcomed Mr. B. Paulson, President of the Norwegian Gas Association, and Mr. J. Irminger, of Bergen; and in Mr. J. A. Helliwell they had a visitor from the Dominion of New Zealand.

The Secretary, Dr. W. T. K. Braunholtz, O.B.E., announced greetings from Mr. Clifford Paige, of New York, from the President of the Belgian Gas Association, and from the Gas Associations of Switzerland, Austria, Italy, the Netherlands, the Saar, Spain, and Sweden.

A Further Generous Gift

Mr. Dyde then moved the adoption of the annual report of the Council of the I.G.E. for 1951-52, and the accounts for the year 1951. Many of them, he said, would remember that at the last autumn research meeting he had the pleasure of announcing the gift of £3,000 from Mr. Charles Dempster for the endowment of a Travelling Fellowship. It was with particular pleasure that he now drew attention to a generous offer that had been made to the Council by Mr. T. C. Finlayson and his colleagues at the Woodall-Duckham Company to enter into a covenant for 10 years which would place in the hands of the Institution an annual sum of £500. Needless to say, this offer had been gratefully accepted. The annual sum might be used for supplementing the income at present available from the various scholarship funds and in any other way assisting in the training of young men for the gas industry. Its use was to be at the absolute discretion of the Institution Council. The fine facilities that the Institution was now able to offer in the way of scholarships and the generous assistance to students and graduates would act as an incentive and be a means, he was sure, of attracting entrants of the right quality into the gas industry against the competition offered by other industries.

The second point to which he would refer was the Gas Gallery at the Science Museum, South Kensington. The Council had had the opportunity of a pre-view, and he would like to record their indebtedness to Mr. F. M. Birks and his Committee, working in liaison with the Museum authorities, for the excellence of this presentation.

In regard to the Institution's revenue account, they would note that the 1950 account showed a deficit of approximately £300, but in this year's account, due almost entirely to the increased cost of printing and stationery, the deficit had risen to £1,572. This rate of loss on the Institution's account could not be allowed to continue, and it was for this reason that later on in the meeting they had to bring forward a resolution for an increase in the rate of subscription for most classes of membership.

Mr. A. McDonald (North Eastern Gas Board) seconded the motion.

Mr. L. T. Minchin (London) enquired whether it was possible to improve the machinery for answering questions at Institution meetings. When a paper was read, it was extremely valuable if, quite apart from prepared speeches, questions for the

purpose of elucidation could be asked and answered. The present machinery did not seem to allow for that, and one might find one's question answered some nine or 12 months later.

Election of Officers

President, 1952-53: G. E. Currier, O.B.E., M.I.MECH.E.

Vice-President, 1952-54: W. K. Tate, M.A., A.M.I.C.E.

Auditors: Colonel H. C. Smith, C.B.E., and E. D. Davey.

Hon. Secretary: John Terrace.

Council, 1952-55: D. Beavis, Dr. J. Burns, W. S. Hubbard, A. Tran.

Honorary Members: D. M. Henshaw, Chairman and Joint Managing Director, W. C. Holmes & Co., Ltd.; F. H. Jones, formerly President, South Metropolitan Gas Company (see p. 674).

There were also elected 14 Members, 37 Associate Members and 29 Associates.

District Members of Council:

The Secretary reported that the following had been nominated District Members of Council by the District Sections of the Institution and affiliated District Gas Associations, for the year 1952-53; G. E. Anderson, North of England Section; R. Cowie, Scottish Association; A. H. Dyer, British Junior Gas Associations' Joint Council; Dr. A. E. Haffner, London and Southern Section; J. H. Lowther, South Western Section; A. McDonald, Manchester and District Section; A. Pickard, Wales and Monmouthshire Section; F. A. Rhead, Eastern Section; J. E. Wakeford, M.B.E., Midland Section; G. Walmsley, Irish Association.

Presentation of Medals

Mr. Dyde said it was the President's privilege each year to present the medals and prizes awarded by the Institution for outstanding contributions to the technical knowledge and for valuable services rendered to the gas industry. On this occasion all the awards had been made, including that of the Birmingham Medal, which was the highest such honour that the Institution could bestow. The first award of this medal was made to Sir George T. Livesey in 1882, and in the last 70 years only 18 persons had shared with him the distinction of receiving this medal. The list included names of international reputation, such as W. H. Perkin and Baron von Welsbach. To this list they now added the name of Dr. Edward Victor Evans, O.B.E.

Dr. Evans was a Londoner, educated at Westminster City School and King's College, London. For nearly half a century he served the great South Metropolitan Gas Company as Chief Chemist, General Manager, and, finally, Joint Managing Director. Essentially a chemist and proud of his profession, Dr. Evans strove consistently and successfully throughout his distinguished career to raise the the status of the chemist, to the great benefit of the industry. His constant aim had been to apply scientific methods to the carbonisation of coal and the treatment and use of its products. They would recall his work in collaboration with Dr. Charles Carpenter, resulting, in 1910, in the introduction of a process for the

G.J. 4368

The President gives his Address: On his right is Colonel H. C. Smith, C.B.E., Chairman of the Gas Council; on his left are Dr. W. T. K. Braunholtz, O.B.E., Secretary of the Institution, and Mr. John Terrace, Hon. Secretary.

removal of organic sulphur compounds from coal gas by the use of a nickel catalyst. This application was years in advance of such development elsewhere.

The same originality of thought applied to the practical and theoretical aspects of carbonising was to be found in the Cantor Lectures which Dr. Evans gave to the Royal Society of Arts in 1924, in the William Young Memorial Lecture of 1928, and in his Presidential Address to the Institution in 1943.

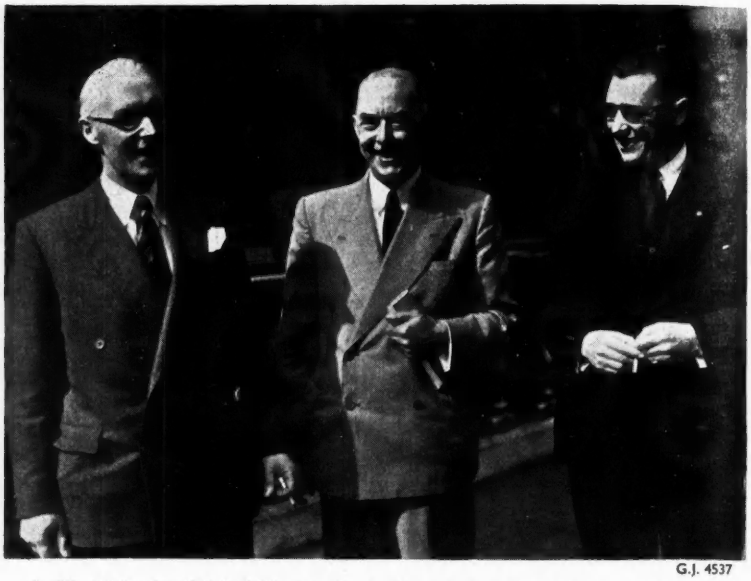
Dr. Evans took a leading part in the formation of the Gas Research Board and was its Chairman from 1939 to 1947. Among other things, he initiated researches aimed at obtaining greatly increased yields of gaseous hydrocarbons per ton of coal by methods of complete gasification combined with synthesis. If they could wish for something that would please him most, he thought it would be that he should enjoy good health and live long enough to see this fundamental research translated into full process application and to witness the advantages to the industry which he foresaw fully realised.

It was fitting that in 1943 the University of Leeds should award to Dr. Evans the degree of Doctor of Science (*honoris causa*). It was fitting now that as a worthy successor to his old chief, Dr. Charles Carpenter, he should be called upon to receive the Birmingham Medal.

A Catalyst for Achievement

Dr. E. V. Evans said that when he entered the gas industry more than 50 years ago there was an immense amount to be done in getting a better appreciation of the chemistry and physics of gas processes. Although he was full of enthusiasm, he did not think that he possessed any more brain power or creativeness than the ordinary young man of his day, but what he did have—and what was very precious—was great encouragement from the masters under whom he served. Encouragement was indeed a catalyst for achievement.

There was still an immense amount of work to be done in the industry, and he was afraid it was axiomatic that under nationalisation there must be more regimentation than in a free industry. They must see that that regimentation did not destroy initiative. He felt sure that the Gas Council, the chairmen and vice-chairmen of the area boards, and the high executive officials of the industry were doing their utmost to encourage those who found a great deal to do and were full of enthusiasm.



G.J. 4537

J. M. McLusky (Wakefield), N. G. Appleyard (Leeds), and N. C. Sturrock (Harrogate).

Mr. Dyde then presented the Institution Gold Medal, 1951, to R. F. Hayman; the H. E. Jones London Medal, 1951, to Dr. J. Burns, G.M.; the Institution Silver Medal, 1951, to T. Nicklin and M. Redman; and the Institution Bronze Medal, 1951, to R. W. N. Cameron.

In presenting the William Dieterichs Memorial Prize, 1951, to J. F. Waight, the President commented that this was the first occasion on which the William Dieterichs Memorial Prize had been given, and he would remind them that it was awarded for the best paper dealing with the industrial application of gas delivered on any recognised British platform. It was in memory of that most likeable personality who did so much to advance in a practical way the use of gas in industrial process work.—(See page 675.)

Presidential Address

We then came to the presidential address (page 676), in the course of which Mr. Dyde pictured the American scene, giving impressions of his recent visit to the States as leader of the British Gas Industry Productivity Team. He drew attention to the rapid change-over that has taken place over the last decade from manufactured to natural gas throughout the length and breadth of the States. It was significant that in 1951 over 90% of the total therms sold by the American gas industry was from natural gas, brought to distributing centres by 109,000 miles of transmission main. These mains were up to 30 in. in diameter and operated up to pressures of 1,000 lb. per sq. in. The Transcontinental Gas Pipeline Company began sending natural gas through its approximately 1,800-mile Texas to New York line during the last few days of 1950, and was the latest of some 17 major pipeline companies.

There were now only 12 gas-production centres carbonising coal, and these weer all coke oven plants; by the end of 1952, this number would be reduced to five. During the delegation's visit, the great Brooklyn Union Gas Company of New York was making the biggest change-over in history directly from mixed coke oven and carburetted water gas of 540 B.Th.U. to straight natural gas of 1,050 B.Th.U., and re-designing its existing carburetted water gas plants to function as oil gasification units. These sets, together with liquid butane storage, would in future meet demands unable to be met from their present allocation of natural gas, and also act as a standby against trouble on the bulk supply pipeline.

This tremendous asset of natural gas had completely transformed the economy of the American gas industry, which in a number of States, particularly those of the eastern seaboard, had been under considerable strain as a result of competition from

oil and electricity and the restriction on gas prices as imposed by the State Regulating Committee for Public Utilities.

Even in New York, which was at the end of 1,800 miles of pipeline, natural gas could be sold at 25% cheaper rates than manufactured gas, while in other areas, more favourably placed to receive it, it retailed at a price that made it cheaper than coal, oil, or electricity on a gross thermal basis.

In these circumstances, the industry had developed its industrial load and its domestic space heating load to an enormous extent. Some companies that had had the advantage of a natural gas supply for a long time and were working at low price obtained through building up a good load factor on their transmission line had reached 70 to 90% saturation in domestic house heating. In this way, the American gas utility industry had grown almost two-and-a-half fold in the last decade.

Tributes to the President

Mr. W. K. Tate (Junior Vice-President), proposing a vote of thanks for the address, said he had known Mr. Dyde for almost the whole of his period in the gas industry. Mr. John Dyde, as they all knew, had progressed steadily but rapidly in his engineering career. To many of his friends there had been no doubt whatsoever for a long time that he was a man marked out for the most responsible posts which the industry could offer. That week they had seen the culmination of his presidential year, and when they selected him, 12 months ago, for the highest gift that they could give they not only recognised his worth in a fitting fashion but conferred a very considerable benefit upon themselves. Mr. Dyde was notable for his energy and his determination. It was not surprising, therefore, that during his year of office he had devoted himself indefatigably to the manifold duties of his office, duties which by reason of the times and the order of things to-day required a very great display of tact, perseverance, and, he might almost say, of guile—and so they could sum it up and say statesmanship.

Mr. Dyde had borne this burden outstandingly well. By a very proper courtesy, of course, the address as such was not open to discussion, but it had almost become a professional duty to make statements of a controversial nature. Mr. Dyde had amply fulfilled that requirement and had enabled them all once more to clarify their minds and test their reactions towards the many problems with which they were faced. Particularly

G.J. 4364

Dr. E. V. Evans, O.B.E., responds on being presented with the Birmingham Medal—the Institution's premier award.

did he commend to them his words regarding the newly launched education scheme; and he commended them to those whose consciences make them most sensitive.

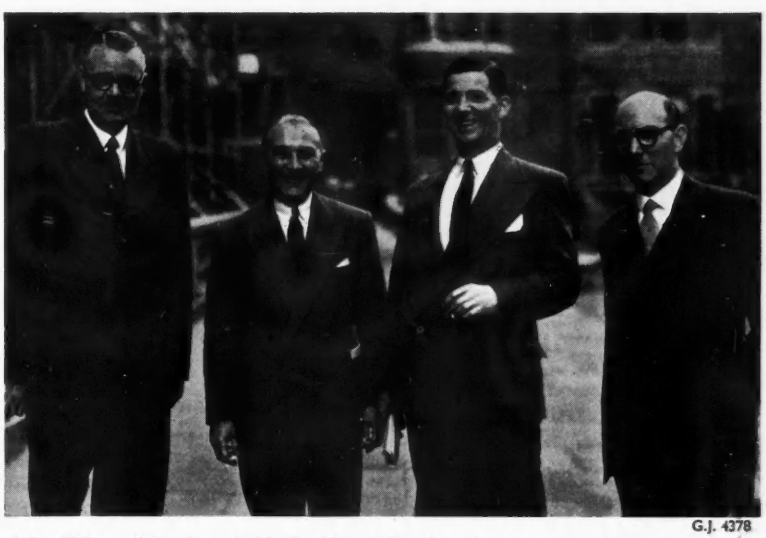
The Institution might well be proud that the representative of the productivity team which had recently returned from the United States was not only the President but also Mr. Dyde, and he personally would have given much to have witnessed his powerful impact on the more volatile elements that inhabited that great Continent.

The President could do much for the Institution in his year of office. He could provide food for much thought in his address; and he submitted that Mr. Dyde had achieved outstanding success in both spheres. Those who had had the privilege of sitting beneath him in Council knew full well how ably the affairs of the Institution had been guided.

Stepping Stones to Fame

Mr. A. G. GRANT (Director and General Manager, Whessoe, Ltd.), in seconding the vote of thanks, said he was not one of Mr. Dyde's new friends. They were students together at Leeds. Mr. Dyde read chemistry; when he had read chemistry he wondered what he was going to do about it and had in his mind going to Oxford to read education so as to teach other people how to read chemistry! But he fell in with a young student who was wise in the art of salesmanship who told him all about the great gas industry and what a wonderful career he could make for himself there. The advocacy worked, and he read fuel and gas engineering under Professor Cobb and others at Leeds. They could imagine the pride he (the speaker) felt personally that he had some slight hand in directing Mr. Dyde at the beginning of the course which had led him to the Presidential Chair.

His pleasure in seconding the vote was also professional. Mr. Dyde had approached all problems with liberality of outlook and an enquiring mind, and he had tried to find out what seemed the sensible thing to do before reaching conclusions. That



G.J. 4378

John Wilson (Manchester), T. D. Olver (Manchester), A. L. Nicholson (Blackburn), and R. L. Greaves (S. Lancs.).

had proved enormously helpful in the many difficult problems which they had had. Mr. Dyde had continued the interest he had had over many years in education. Many of them felt that there never would be shoulders to take the mantle of Mr. John Terrace, but Mr. Dyde had fitted that mantle perfectly.

In his address that day, Mr. Dyde had dealt wisely with their industry and its problems, and he was reminded of another eminent President, Sir Dugald Clerk, who in 1920 read his presidential address on the future of the gas industry. The two had something in common, but Sir Dugald batted on a far easier wicket. The overall efficiency of producing electricity in those days on an average was 7½%.

G.J. 4372

C. H. Riley, F. R. Jenks, J. Bateman, and J. Smith (Sheffield and Rotherham).

The French Gas Industry

This brought us to the first paper at the meeting—that by M. J. Kec on 'The Gas Industry in France; its Evolution, its Programme, its Prospects.' A summary of the paper, translated by Mr. D. B. Parkinson (Eastern Gas Board) was read by Mr. Parkinson at the meeting. In the course of this summary M. Kec commented that since 1947 the gas industry in France had undergone a complete transformation, both in its organisation and its technology. There were two causes responsible for this evolution. The first had been the nationalisation of nearly all of the French gas undertakings which, instead of being distributed among 200 different companies, were now grouped under a single management —that of Gaz de France. The extensive sectionalisation which was a characteristic of the French gas industry before the war had given place to centralisation. The programmes of modernisation or extension of works which formerly were considered from the purely local angle were now examined within the framework of a national constructional programme. In place of many production units there had been substituted concentration in a limited number of large works. The concentration of production had given rise to the necessity for laying arterial transmission mains over long distances.

The second cause was economic. Gaz de France no longer had coal alone as a basic raw material, but it utilised to the best advantage of the French national economy, coal, products from the petroleum industry, gas obtainable from the metallurgical industry, collieries, or the chemical industries, and natural gas. They were reserving coal for base load production in the large works, but the need for carbonising a proportion of coal with high volatile content and little or no coking power had led them to a general introduction of plants for the preparation of coals by crushing and blending with the objection of producing, notwithstanding, a coke suitable for industry or usable in blast furnaces.

Use of Propane

Gaz de France was daily becoming an increasingly important consumer of propane. This product could be used as a peak load gas either by mixing propane with producer gas or water gas, or by means of cracked propane enriched with pure propane. When associated with gas from complete gasification, it gave in its pure form an enrichment gas, or in conjunction with cracked propane a peak load gas.

The small undertakings which could not economically be linked with long distance bulk transmission mains would distribute either pure propane, propane-air, or cracked propane enriched by propane. The regions adjacent to the natural gas fields were fed by pure natural gas or reformed natural gas.

These gases of very varying composition had neither the same calorific value nor the same specific gravity nor the same speed of flame propagation, and their combustion characteristics were entirely different. Gaz de France had been able, after patient research by M. Delbourg, to try out a method by which it was possible to tell in advance, according to the anticipated composition of a gas, whether it could or could not be used in domestic appliances without modification of the burners, and eventually to forecast the faults to be corrected—*e.g.*, the chance of incomplete combustion, lighting back, or flame lifting.

Having outlined the work in the various regions, M. Kec went on to say that the complete implementation of the programme would enable net costs to be appreciably reduced by means of an increase in thermal yield, economy in manual labour, and improvement in receipts from by-products. This lowering of net cost would facilitate expansion of sales. These had, in any case, considerably improved, as they were about 50% higher than pre-war.

Rising Sales

The continued rise in domestic utilisation was maintained. The growth of space heating was very rapid and was causing embarrassingly heavy peak loads. Their greatest hopes were in the expanding use of hot water appliances and refrigerators, in the replacement of hotplates by cookers with thermostats and, in a general way, in the improvement of the French standard of living.

In regard to the sales of gas for commercial and industrial use, they were increasing very rapidly in spite of competition from heavy oil, and the sales potential was far from saturated. The results achieved had been most encouraging and it was with the

greatest confidence that they looked to the future.

President's Luncheon

Following discussion on the paper the meeting adjourned, and in the interval the President's luncheon was held at the Savoy Hotel, the guest of honour being Sir Hubert Houldsworth, Q.C., Chairman of the National Coal Board. At the luncheon there were present representatives of 14 other countries, including all countries of the Commonwealth; and there were 17 presidents or chairmen of kindred organisations. (See page 680.)

South Wales Gas Grid

On resumption in the afternoon there was before the meeting a paper by Mr. W. R. Branson and Mr. W. T. Hird on 'The South Wales Gas Grid.' Each author gave a brief presentation.

Mr. Branson explained that in the few minutes available he would review briefly that portion of the paper which dealt with the planning of supplies, while Mr. Hird would introduce the later sections which described the design and construction of the grid.

The 'grid' area was roughly 50 miles by 30 miles and had a population of about 1.5 mill. This population had its greatest concentration in the coastal towns. In the hinterland lay the coalfield, the mining towns and villages being thickest in the east. A sparsely populated belt divided the area centrally.

Prior to World War II South Wales had suffered severely from the economic depression and the consequences were reflected in the gas industry. The output of the 41 separate undertakings amounted in 1948 to 11,700 mill. cu.ft., or about 7,800 cu.ft. per head of population, compared with the national average of 10,800 cu.ft. Domestic consumption averaged about 100 therms per annum and there were estimated to have been about 115,000 houses, largely in the mining areas, without a supply of gas at the end of 1948. Industrial consumption accounted for 20% of the total sales.

The increased output of gas achieved between 1938 and 1948 had been made possible by the utilisation of coke oven gas from both colliery and steelworks ovens. In the latter year gas undertakings purchased nearly 7,000 mill. cu.ft., or 60% of their requirements, while a further 8,500 mill. cu.ft. was used internally in integrated steelworks.

The proposal of the National Coal Board to erect a new coke oven plant at Nantgarw, near Pontypridd, and

G.J. 4370

M. Jean Kec introduces his paper on the French Gas Industry.

the extensions planned by the Steel Company of Wales to the coke ovens at Margam, near Port Talbot, led in 1947 to the setting up by the Ministry of Fuel and Power of two committees, representative of the gas industry in South Wales, to study the utilisation of the resulting coke oven gas. The plans prepared by these committees and published in 1948 had formed the basis for subsequent developments, and it was desired to acknowledge that without the work done prior to nationalisation, both in planning and in actual construction, it would have been impossible to make the progress recorded in the paper.

Between the publication of the committees' reports and May 1, 1949, the Wales Gas Board was informed by the National Coal Board of plans for a further large coke oven plant at Cwm, also near Pontypridd. This and other factors led to a review of the gas supply position throughout South Wales. The results of this review might be summarised as follows:

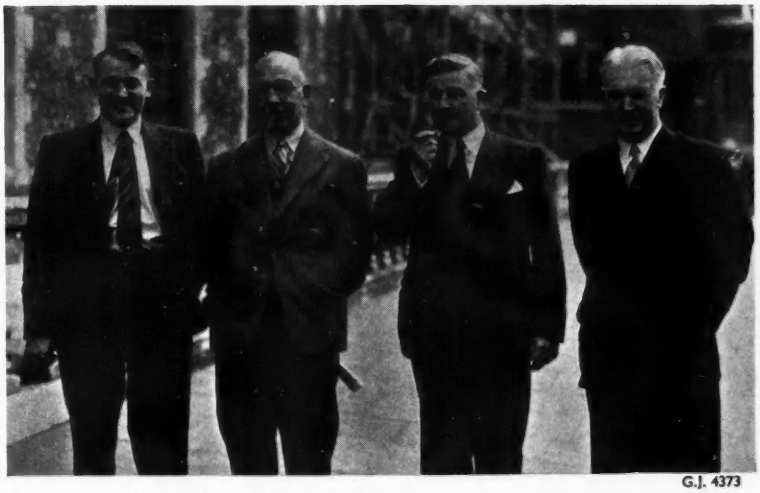
(1) With the exception of the new works, capacity 4 mill. cu.ft. per day, then nearing completion at Pontypool, most gasworks carbonising plant would require replacement or major reconstruction within 10 years.

(2) Demand for gas was growing rapidly and maximum daily requirements were estimated to rise from about 45 mill. cu.ft. in 1948 to 63 mill. in 1953 and to 92 mill. cu.ft. in 1970.

(3) Annual load factor on gasworks plant was poor due to the large proportion of base load coke oven gas purchased.

(4) Coke oven capacity was expected to grow rapidly and to exceed 10,000 tons per day by 1960. The output from existing and proposed colliery ovens, using producer gas underfiring where possible, plus contract quantities from steelworks was estimated to be about 56 mill. cu.ft. per day by 1960.

The above and other considerations confirmed the desirability of complete integration throughout South Wales. It was, however, decided, in view of the heavy mainlaying programme involved, to proceed



G.J. 4373

D. A. Foster (Wellingborough), P. T. Harris (Kettering), T. Watson (Rushden), and J. Corrigan (Northampton).

G.J. 4354

D. Muir (George Orme & Co.), W. E. Whitney (Bridgend), D. Muir (Pontypridd), K. E. Muir (Wellington Tube Works), and T. E. Taylor.

initially with the construction of two separate grids.

In view of the many uncertainties, flexibility of the long term plan was regarded as of major importance. This could be provided by the choice of location and size of unit selected for the gasworks stations, for which suitable sites at Pontypool, Cardiff, Port Talbot, and Swansea were available.

As a first step, water gas plant of 6 mill. cu.ft. per day capacity, together with purification and compression plant for 12 mill. cu.ft. per day of mixed coke oven and water gas had been ordered for the Port Talbot works. The next step in gasworks construction would depend upon the growth and location of future demand, but it was envisaged that, by 1970, coal gas plant of a total capacity of 25 mill. cu.ft. per day would be required, distributed between Pontypool, Cardiff, Port Talbot and Swansea, while water gas plant of 15 mill. cu.ft. per day total capacity would be needed at Cardiff and Port Talbot.

Design of the Grid

Mr. Hird said that the grid had been designed so that a wide variation in the location of future availability of gas could be met. In the sections so far completed this had been made possible by the construction of what might be called 'bus bars' between Port Talbot and Swansea and between Cardiff and Pontypridd. The completed system was visualised as comprising a central 'bus bar' running from Newport in the east to Swansea in the west, and the sizing and timing of the sections between Caerphilly and Newport and between Nantgarw and Pyle or Port Talbot provided a large measure of flexibility to meet the many uncertainties that remained to be resolved.

The area of the South Wales grid was geographically most complex and the selection of routes and the actual laying of the mains had provided many interesting problems. Rather more than one-half of the final scheme had now been completed and some account of the methods used was given in the paper. Every endeavour had been made to find routes with the conditions most suited to long life of the mains. Of the mains so far completed in the eastern section, 45.4% had been laid away from highways.

An Interim Report

The paper could only be an interim report. Much remained to be resolved before the final sections could be completed. It was, however, encouraging to compare the progress already achieved with that estimated in 1948 and 1949. The cost of the sections completed in the eastern area compared very favourably with the estimates. Unless, however, there was a reversal of the prevailing trend of rising prices, it was improbable that the remaining sections would be completed without some increase of the original estimated cost.

Subsequent to the preparation of the paper, the figures of gas sent out for the year ended March 31, 1952, had become available, and it was most encouraging to find that the demand estimated for the eastern section in 1953 had already been exceeded.

Various well merited tributes had been paid in the paper to those who had done so much in the planning, design, and construction of the grid. It was, they felt, also fitting that two further tributes should be paid—to the officials of the Ministry of Fuel and Power, who had been closely connected with this scheme from its very inception, and who had been most helpful in so many ways; and finally, the laying of the all-important mains in the eastern section could not have been completed without the generous help of seven area boards which, in 1949, agreed to defer schemes so that pipes could be available in April, 1950, for the work to commence.

Increase in Subscriptions

The final item on May 27 was a special general meeting of Corporate Members called to consider proposals for increasing the revenue of the Institution.

For the first time in 21 years, said Mr. Dyde, the Institution account showed a deficit of about £300 in 1950, and the account for last year showed a deficit of £1,570. The deficit for this year, ending December, 1952, would obviously be higher, owing to the generally rising costs, than the present deficit of some £1,500. But the Council and the Finance Committee of that Council had been very active in considering ways and means by which that deficit could be kept as low as possible before action could be taken to bring the finances on to the right side of the ledger.

The expenditure item, which had risen disproportionately was that of communications, printing, and stationery. Rent, rates, etc., still represented about the same proportion as they did in 1936. The proportion of the expenses on the Institution account which was due to salaries had remained, in percentage, the same.

On the other hand the printing of their transactions, communications, and the general printing associated with the holding of annual meetings, had increased enormously—he might even say, fantastically. In 1936 the transactions cost £455; last year, £998. Their general communications, printing, and stationery cost £226 in 1936, and in 1938, £230, but last year the figure was £2,521.

The Publications Committee had considered how these printing costs

might be reduced. They had suggested, for instance, that they now eliminate the printing of the grey edition; but the advantage was only a matter of £200 to £300.

One other item which had, of course, increased their printing and stationery costs was the publication of the *Bulletin*. They had asked the various district sections whether they thought that the *Bulletin* in its present form was a worth-while contribution, and the replies that had come in all indicated that it was indeed a publication welcomed by members. It cost about £500-£550 a year; and the Council felt, as a result of the information they had obtained from the district sections and members generally, that they should continue with the *Bulletin*.

G. J. 4361

W. A. Pask (Leicester), A. Robertson (Drakes, Ltd.), P. T. Harris (Kettering), and T. Watson (Rushden).

Only Way to Safety

The only way in which they could increase their revenue on the Institution account—at any rate, the only safe and reliable way—was to increase the annual subscriptions. The Council had looked into the matter very carefully, and they felt that an increase was necessary in the rate of subscriptions to full members, from £3 13s. 6d., as at present, to £5 5s.; associate members from £2 2s. to £3 13s. 6d., and for associates from £2 2s. to £3 13s. 6d.; and a corresponding increase in the compounded annual subscription for members, associate members, and associates from £50 to £85 a year. There was no suggestion for raising the subscription of student members, or for increasing the entry fees or the transfer fees from one class of membership to another.

Mr. J. T. Haynes, Chairman of the Finance Committee, said the President had expressed in no uncertain terms the difficulties in which the Finance Committee of the Institution found themselves. He would just stress what the President had already explained—that the increased costs were not due to any increase in the staffs or overheads in the way that some of them had met with in other organisations with which they were connected. They had during recent years increased the services which the Institution gave to its members, more particularly in the periodical *Bulletin*, which kept the members *au fait* and up to date with everything which was done by the Council. The main cause of their increased costs was something quite beyond their control —the cost of raw materials. For that reason, they had no option but to submit the increase in the cost of subscriptions to the Institution.

Mr. Haynes then moved the resolution for increases in subscription rates, and Mr. A. H. Dyer seconded.

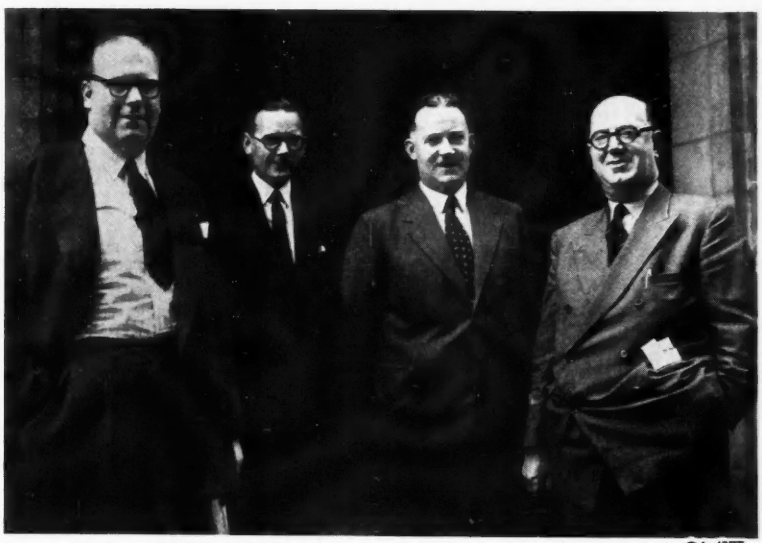
Mr. W. H. Blundstone thought that no one should not support the motion; but he was doubtful whether the *Bulletin* was worth the £500 which it cost.

Amendment Proposed

Dr. M. Barash suggested that, while he appreciated that the Council must have given very careful thought to the amount by which it was proposed to increase the subscription, it was not opportune at the moment to cater for several years in advance. He would like to propose as an amendment that the subscription be increased universally by one guinea, which would give an increased income of £3,000, against a deficit of £1,500. And he proposed that the compounded fee of 50 guineas be not increased.

Mr. E. M. Pool seconded Dr. Barash's proposal.

Mr. G. E. Currier (Vice-President) commented that the subscriptions to the Institution had not been increased since 1937; and if the proposal was accepted, all the subscriptions would be in line with those of



G.J. 4377

S. Armitage (Parkinson & Cowan, Ltd.), G. Hogg (Ewart & Sons, Ltd.), D. I. Rowlands (Rhymney & Aber), and T. B. Armitage (Parkinson Stove Co., Ltd.).

other kindred organisations.

Dr. Barash said he did not think it was a valid argument to say that they should fall in line with other institutions. The important thing was to cover their commitments. While, as the President had pointed out, the deficit was at present something in the region of £1,500, he did not see that there was any reason at present to increase their income by £4,500 at one fell swoop.

Mr. Dyde pointed out that past deficits had to be funded.

Mr. Norman Hudson, M.B.E., remarked that if they merely raised the subscription sufficient to cover what the Finance Committee might consider to be the deficit this year, they would be asking the Institution and the Council to run the Institution almost on the edge of a sword.

Mr. Dyde then put the amendment which had been proposed by Dr. Barash and seconded by Mr. Pool.

The amendment was negatived on a show of hands.

Mr. Dyde finally put the resolution as proposed by Mr. Haynes and seconded by Mr. Dyer.

The motion was carried *nem con.*

Reception and Dance

The Reception and Dance took place on the Tuesday evening at the Connaught Rooms, Great Queen Street.

Oxide Purification in Towers

On resumption of the meeting on the morning of May 28 there was presentation and discussion of a paper on 'Oxide Purification in Towers: Aspects of Operation and Control,' by R. G. Warr (Engineer, Nechells works) and E. T. Pickering (Deputy Chief Chemist, Central Laboratories), West Midlands Gas Board.

The tower purifier installation at the Nechells works consists of two sections, each having a nominal capacity of 12 mill. cu.ft. of gas per day. The authors explained that on completion in January, 1949, the towers of the first section were charged with new oxide and put to work. After a few months it became apparent that the towers were not operating satisfactorily and with that reserve of capacity essential to the peace of mind of the gas engineer. This was contrary to the experience at the Wandsworth works of the South Eastern Gas Board, where tower purifiers had operated satisfactorily since their installation in 1938, and also contrary to later experience at the Neepsend works, Sheffield, of the East Midlands Gas Board, where a tower installation went into operation in December, 1950. The investigations described in this paper were undertaken to determine the reasons for the difficulties experienced at Nechells, and thus to obtain the knowledge required to overcome them.

G.J. 4375

L. Hartley and S. C. Thomson (Clayton, Son & Co., Ltd.).

The investigation revealed two main reasons for the difficulties encountered:—

(1) The formation of a hard and relatively impermeable layer of spent oxide in contact with the supporting grids at the base of the upper layers of oxide in each container. This caused these (upward-flow) layers to throw higher back pressure than that thrown by the lower (downward-flow) layers, and resulted in maldistribution of the gas; too great a proportion passed through the lower layers.

(2) The drying out of a considerable proportion of the oxide contained in the upper layers, which caused the affected oxide to lose its activity.

It was considered that the latter difficulty arose at Nechells, primarily, because the hydrogen sulphide content of the gas to be purified was higher than at Wandsworth or at Neepsend, and the towers were unable to dissipate sufficiently the heat evolved by the sulphiding and oxidising reactions.

The constructional features of towers that prevented sufficient dissipation of heat from the oxide were:

(*a*) the low surface area of towers relative to the amount of oxide contained within them, and

(*b*) the heat insulating properties of the outlet gas annulus, which surrounded the oxide.

The cause of local hardening of oxide in contact with the grids was thought to be due to local overheating caused primarily by the restricted surface area of oxide presented to the gas containing high concentrations of hydrogen sulphide when a tower was operating as first taker. High operating temperatures, and the use of very active new oxide, doubtless contributed to this difficulty.

Measures taken to bring about more satisfactory conditions included the use of mixtures of new and part-spent oxide (double exposure), the objects being to minimise or avoid local hardening and to replenish the moisture content of the oxide; and the introduction of steam at the inlet fourth and/or fifth taker, depending on atmospheric and other operating conditions. These measures had met with some success, but more remained to be done before the performance of the tower installations at Nechells could be regarded as satisfactory.

Benevolent Fund

A general meeting was then held of the contributors to the Benevolent Fund of the Institution. (See page 729.)

Gas Purification

The other item on the morning of May 28 was presentation and discussion of a paper on 'Progress in Gas Purification,' by Dr. H. Hollings, O.B.E., who explained that active steps are being taken to manufacture a purifier mass of high quality from the copperas which has recently become available as a waste product. For a few years the great bulk of this artificial bog ore will be used in existing purifiers or in purifiers which do not differ markedly from conventional design.

It is anticipated that active development will take place in connection with several improved designs of purifier plant, and it would appear that there is every reason why there should be healthy competition in this field even though there may be some overlapping. The problem of saving ground space and of improving labour conditions had been with them, said Dr. Hollings, for some years now, and its solution was becoming more urgent.

It is the intention of the North Thames Gas Board that from time to time a few tons of the precipitated iron oxide should be withdrawn from the plant which is about to be erected. These samples will be used for the purpose of large scale experiments in connection with the preparation of material in such a physical form that it can be used with a much higher space velocity than has hitherto been normal in purification practice. Some of the laboratory experiments have indicated the possibility of working with purifiers having only one-twentieth of the volume of conventional purifiers.

The specially prepared iron oxide may prove to be more expensive, and so it may be uneconomic to burn it in an acid plant. Furthermore, there is an insistent demand for pure sulphur. For these reasons, work will continue on the toluene extraction processes. If the extracted material is recycled for use in the gas purification stage, the cyanogen compounds will accumulate in the mass, and so, in the not-far-distant future, it will be necessary to give further consideration to their extraction and utilisation.

While these developments are taking place in connection with the iron oxide process, a trial will be made on a commercial scale of the liquid purification process. This already presents as secondary questions the choice of the best method of burning hydrogen sulphide, whether to acid or to sulphur, and the best way of dealing with hydrocyanic acid, whether by combustion or by hydrolysis.

In 1942 the Koppers Company installed a new process at Pittsburg. As in some earlier processes of this company, the gas was washed with a solution of sodium carbonate, but the sulphided solution was reactivated by heating under reduced pressure instead of by oxidation. In 1948, a second plant was installed by the Koppers Company at the Seaboard coking plant in New Jersey. The operation of these plants has been investigated very thoroughly in conjunction with the Woodall-Duckham Company, and the North Thames Gas Board has decided to install a plant having a capacity of 13 mill. cu.ft. of gas per day at Beckton.

Finally, remarked the author, it should be recognised that the choice of a process for the future should depend on the hydrogen sulphide concentration of the gas, which, for example, may be from 100 to 1,000 times as high in crude coal gas as in the gas leaving the final organic sulphur catalyst, and upon the load factor. Some of the iron oxide processes may be more suitable, in their early stages of development, either for dealing with low concentrations of impurity, or for purifying gas which is only made during short periods of cold weather.

Water-in-Tar Emulsions

At the final session of the meeting on the morning of Thursday, May 29, the first item was presentation by S. C. Porter, Chief Chemist, Ipswich district, Eastern Gas Board, on 'Water-in-Tar Emulsions, with special reference to Sealing Media for Waterless Gasholders.' In a brief review the author said that the paper summarised investigations carried out over a period of years with the object of reducing the water-tar emulsion in an M.A.N. waterless gasholder. The nature of emulsions was briefly reviewed, and the important part played by the toluene-insoluble fraction in stabilising tar emulsions was indicated. Published data indicated, and experience of a number of tar emulsions had confirmed, that each emulsion must be considered as an individual case. The Ipswich emulsion was a very stable one, and could not be successfully broken by any of the classical methods.

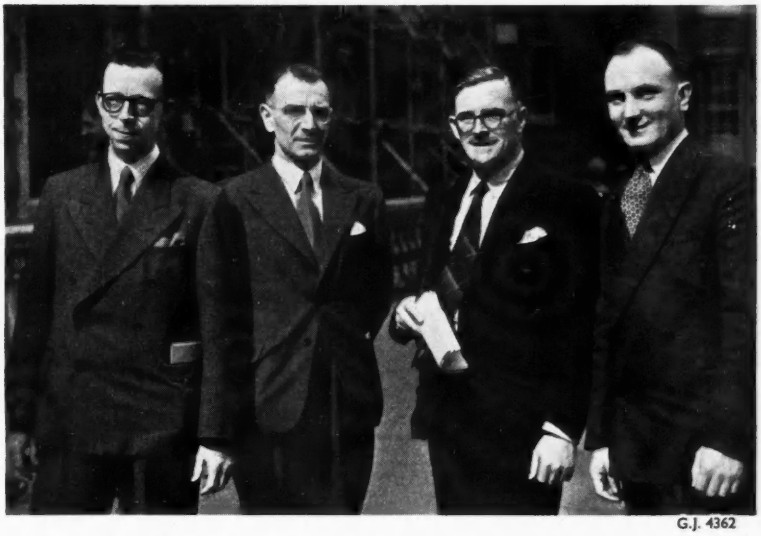
Gas Supply to Four New Towns

Two further contributions completed the meeting's technical fare. The first was by W. A. Evetts, M.C., Engineer to the Watford division of the Eastern Gas Board, on 'Technical and Economic Aspects of the Gas Supply to Four New Towns'—the towns in question being Stevenage, Hemel Hempstead, Welwyn Garden City, and Hatfield. The factors influencing the gas demand and the methods used in estimating the domestic and non-domestic demands are described, and the economic factors that influenced the location of manufacturing plant to supply the new towns, and the distribution systems adopted, are considered.

Gas Manufacture in the Eastern Board Area

The final paper was by E. O. Rose, Engineer to the Tottenham division of the Eastern Gas Board, who dealt with the technical and economic aspects of gas manufacture in the area of the Board. Mr. Rose reviewed the economic position of gas manufacture throughout the area, the difficulties, and the possibilities. In the paper it is shown that with the coals available and the prices ruling at present the cost of gas must be high in comparison with many other areas.

Substantial local savings can be made by the steady closing down of small and costly works, and by their linkage to larger stations. In cases too isolated for such a procedure, the use of butane—air or small carburetted water gas plants presents a reasonable compromise. Butane—



G.J. 4362

M. Newsome (Leigh), K. Snowdon (Bolton), H. B. Higgins (Bolton), and J. R. Hunt (Bolton).

air in particular will enable supply to be maintained in any district where the existing works is considered to be not worth repair, and will maintain that supply until such time as inter-linkage can be effected.

Closing Stages

We approached the end of the meeting when Mr. Sydney Smith, Chairman of the East Midlands Gas Board, proposed and Mr. R. J. Rogers, of the Parkinson Stove Co., Ltd., seconded an omnibus vote of thanks to all who had contributed to the success of the meeting.

Then came a vote of thanks to Mr. Dyde and presentation to him of the Presidential Certificate. Proposal of the vote was in the hands of the Senior Vice-President, Mr. G. E. Currier, who said they looked on John Dyde as one of the best leaders the Institution had had, and he had done much to enhance the prestige of the Institution.

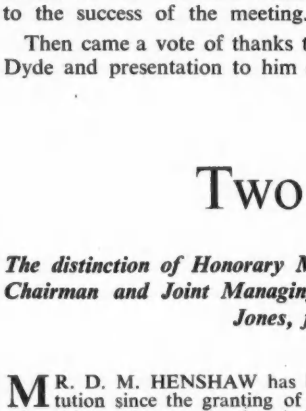
Dr. A. E. Haffner, North Thames Gas Board, who seconded, remarked that Mr. Dyde served on countless committees, but there was one—the Education Committee—on which he had been privileged to serve under him, and there Mr. Dyde showed great skill in introducing new topics. He kept turbulent minorities in order, and yet he was receptive of new ideas. He caused fresh thoughts and conceptions to develop in men's minds until they were led to the conclusion which really was his own all along; and yet they came to that conclusion in the belief and the delusion that it was their original thought, and this, therefore, strengthened their resolution to help forward education even more. Many of them had great cause to be grateful to Mr. Dyde for the special interest he had shown in the newly formed district sections.

The 1953 annual general meeting of the Institution will be held in London on May 19 - 22.

Two New Honorary Members

The distinction of Honorary Membership was conferred during Institution Week on Mr. Daniel Mayon Henshaw, Chairman and Joint Managing Director of W. C. Holmes & Co., Ltd., Huddersfield, and Mr. Frank Harding Jones, formerly President of the South Metropolitan Gas Company.

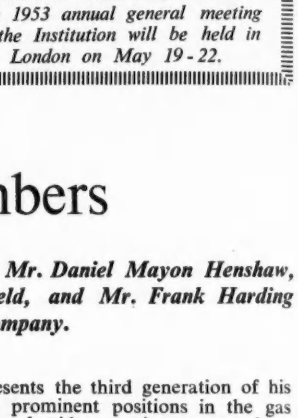
MR. D. M. HENSHAW has been a member of the Institution since the granting of the Royal Charter in 1929, when his predecessor in the chair of W. C. Holmes & Co., Ltd., was made on Hon. Member. He was educated at the Merchant Venturers Technical College in his native city of Bristol, where he served an apprenticeship in mechanical engineering before joining the firm of Holmes in 1903. He has served on the Council of the Society of British Gas Industries, of which he was Chairman in 1935, and was for 20 years a member of the Livesey Committee of Leeds University representing the Institution. He was also a founder-member of the Gas Research Board and has served as a member of the Council of the Institution.



He is at present a member of the Gas Gallery Committee of the I.G.E. which he founded in company with the late Mr. Thomas Hardie, whom he succeeded as Chairman for a short time following the last war, but resigned due to ill health in favour of Mr. F. M. Birks. He has always been a keen supporter of the I.G.E. Benevolent Fund and served for some time as a member of the Committee.

Mr. Henshaw's recreations are golf, fly fishing, walking, and literature, particularly historical, and he derived a love of cricket from 'W.G.', an idol and neighbour of his youth. He is a member of the Newcomen Society and an antiquarian. Outside the gas field he has been Chairman of the West Riding Group of the Engineering Employers' Federation Committee and of the Huddersfield Engineering Employers' Council, President of the Huddersfield Engineering Society and Huddersfield Society of Model Engineers, a member of the Council of the Huddersfield Y.M.C.A., of which he is also a Trustee, with a special interest in boys' clubs, and a member of the Board of Governors of the Huddersfield Royal Infirmary.

MR. F. H. JONES represents the third generation of his family which has held prominent positions in the gas industry. He is an engineer of wide experience apart from his work in the industry. Educated at Rugby he became an articled pupil and afterwards an assistant to the late Sir John Wolfe Barry, under whom he worked on the erection of Tower Bridge and on the underground railway in Glasgow. In 1896 Mr. Jones became a partner with his father, the late Mr. Henry E. Jones, one time President of the Institution of Civil Engineers, and from that time until nationalisation he spent all his time in organising and managing gas and water companies.

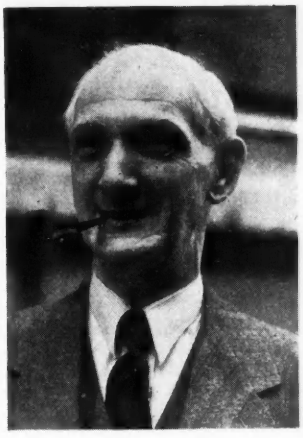


His main responsibility was that of President of the South Metropolitan Gas Company, a position to which he succeeded on the death of Dr. Charles Carpenter in 1937. He was also Chairman and Managing Director of the South Suburban Gas Company, Chairman and Joint Managing Director of the Wandsworth and District Gas Company, Chairman of the Commercial, Eastbourne, Watford and St. Albans, and Woking and District Gas Companies, and Deputy Chairman of the Bishops Stortford, Epping and District, and Brighton, Hove and Worthing Gas Companies.

Mr. Jones did not allow his active interest in the industry to diminish after vesting day. He is still a Director of the Malta and Mediterranean Gas Company, the Montevideo Gas and Dry Dock Company, Primitiva Gas Company of Buenos Aires, Primitiva Holdings, Ltd., and the Province of Buenos Aires Gas Company. He has been a member of the Institution since 1903, and served on the Council in 1930-34. He was President of the British Commercial Gas Association in 1929 when the annual conference at Eastbourne was graced by the presence of the Duke and Duchess of York (later King George VI and Queen Elizabeth the Queen Mother).

The New President and Vice-Presidents

G. E. Currier, O.B.E., President of the Institution, 1952-53.



J. T. Haynes, Senior Vice-President.

W. K. Tate, Junior Vice-President.

THE 1951 INSTITUTION MEDALLISTS

A FULL account of the presentation of the Birmingham Medal—the Institution's premier award—to Dr. E. V. Evans, O.B.E., appears on page 666. We picture the other medallists here. The Institution Gold Medal was awarded to R. F. Hayman, B.SC., M.INST.GAS E., Industrial Gas Development Officer, North Thames Gas Board, for his paper on the production of high temperatures in industry, presented at the autumn research meeting of the Institution in November last. To Dr. J. Burns, G.M., Chief Engineer to the North Thames Gas Board, went the H. E. Jones London Medal, 1951, for the paper which he gave at the annual general meeting of the Institution in that year. The Institution Silver Medal, 1951, was awarded to T. Nicklin, M.SC., and M. Redman, B.SC. (TECH.), ASSOC.M.INST.GAS E., for a joint paper on the economics of gas production read at a meeting of the Manchester and District Section of the Institution in December, 1951. Mr. Nicklin is Production Engineer to the North Western Gas Board and Mr. Redman Assistant Production Engineer. The Institution Bronze Medal, 1951, went to R. W. N. Cameron, ASSOC.M.INST.GAS E. (South Western Gas Board) for a paper on coke quality given at a meeting of the Western Junior Gas Association in November, 1951. The final award presented at the meeting—and this for the first time — was the William Dieterichs Memorial Prize, 1951, to J. F. Waight, B.SC.(ENG.), M.INST.GAS E. (West Midlands Gas Board), for a paper on the design of tunnel burners read at last year's annual general meeting of the Institution. In presenting the Prize the President reminded members that it was awarded for the best paper dealing with the industrial application of gas delivered on any recognised British platform. It was in memory of a most likeable personality.

Dr. J. Burns, G.M.

R. F. Hayman.

T. Nicklin.

M. Redman.

R. W. N. Cameron.

J. F. Waight.

Presidential Address

Abstract of Comm. No. 403

FUEL POLICY and the AMERICAN SCENE

by

J. H. DYDE, M.Sc.

PERHAPS the most encouraging feature of the year has been the growth in strength and influence of our district sections. By the close co-ordination of their work with that of headquarters, the Institution has been enabled to achieve greater concentration of effort and unity of purpose. A system has thus been created through which technical problems can be rapidly brought to the notice of members and examined in the light of local conditions. New developments can be disseminated quickly, absorbed, and applied. In education, too, the local approach of the district education committees is proving of particular importance. A recent review of their functions in the light of the changed structure of the industry has revealed that they have a future value beyond anything that they have attained in the past.

Throughout my year of office, national fuel policy has been a subject for debate by all organisations interested in the utilisation of the country's fuel resources; indeed, your Senior Vice-President and I have been called upon to address other Associations and to state our views as to the gas industry's part in a national fuel policy. In this connection we had no official industry brief, and spoke only as professional gas engineers. I should personally like to acknowledge the help that I have received in this regard from two of our members, Mr. J. E. Davis and Mr. G. C. Holliday, who have made a special study of the production and utilisation efficiencies of various fuels.

The Aim

The aim of a national fuel policy must be a redistribution of fuel utilisation that will provide a greater amount of useful heat and power from the available raw coal. In this redistribution of fuel usage, the gas industry presents a powerful case. Where gas and electricity are alternatives for the provision of domestic heat services, including cooking and water heating gas requires only about half the coal that electricity would need. This latter statement is derived from consideration of the average efficiencies of production and utilisation, and also takes account of the difference in coal quality as between that delivered to the power station and to the gasworks. Moreover, the gas industry can furnish these services at an appreciably lower capital cost in plant and equipment.

Where coke and bituminous coal are the alternatives in the provision of the main space heating load (and all authorities, including the gas industry, advocate that this load should be taken by solid fuel) 3 tons of coke will do the same work as 4 tons of bituminous coal when both are consumed in modern designs of combustion grates and stoves in which the correct grade of fuel is employed. Whatever combination of fuel is employed for domestic heating services, the dual use of gas and coke provides the lowest expenditure of raw coal. The available evidence on domestic fuel requirements shows that an adequate service can be given in a well constructed house of about 1,000 sq. ft. floor area by the use of 35 to 40 cwt. of coke and 250 to 270 therms of gas per annum. If this were the typical pattern of domestic fuel usage in Great Britain, it would represent a saving of 14 to 15 mill. tons of coal per annum over present consumption.

Accepting these statements as fundamental, their translation in terms of policy would mean:—

(a) An expansion in the tonnage of coal subject to carbonisation.

(b) The arresting of the upward trend in the use of electricity for domestic heating services, with a corresponding promotion in the use of gas for such purposes.

(c) The promoted sale of high efficiency grates and stoves, to replace those of low efficiency, for the purpose of carrying the main space heating and winter water heating loads with solid smokeless fuel.

It is appreciated that there are physical limitations, such as time, shortage of constructional materials and, indeed, of capital, in implementing a policy expressed in such broad and sweeping terms. If an advance is to be made, however, there are certain matters that merit immediate attention: for instance, an assurance could be given that as much coal of suitable grades will be supplied to existing carbonising plants as will enable them to work to the highest load factor consistent with demand.

A reconsideration of the allocation of steel and other constructional material, to enable work now held up on new plant construction to go forward, would be a realistic step in the right direction. A nationally sponsored scheme to encourage the sale of more efficient solid-fuel appliances should not be delayed.

The gas industry, in compatibility with this policy, would have to give the domestic coke market preference to ensure that the new grates were supplied with the smokeless fuel that gives the highest thermal efficiency. Should there be any resulting shortage of coke in industry, there are many cases where its use may be replaced with equal efficiency by steam coal or by oil.

Logical Moves

A removal of the purchase tax successively, first from gas water heaters, to enable a drive to be made on gas water heating as a summer service, and, secondly, from space heaters of the portable type, which can be used ancillary to the solid-fuel grate for intermittent between-season heating, would be logical initial moves in securing coal economy.

A good deal more might be done by the appropriate Ministry in impressing on local authorities, new town corporations, and housing developers the imperative need for providing services and, where specified, fixed heating appliances that have regard for coal economy. The same applies to housing construction, particularly the thermal insulation of ceilings.

There is one point, and one point alone, that can vitiate the whole plan of fuel economy, and that is the continued application by the electricity supply authorities of a tariff system that permits the expansion of domestic heating services at prices well below average cost. The gas industry itself knows that it cannot obtain electricity supplies to its own works, where quantities are large and the load factor good, on such favourable terms as are offered for domestic loads of poor load factor and where gas itself is in competition.

Should the electricity industry not appreciate and rectify this position, there would remain but recourse to legislation.

Assuming that an enlightened spirit will prevail in the pursuance of a national fuel policy, the gas industry would take up more of the domestic load, and the electricity supply industry would be able to catch up on its demand through the new generating stations now being erected, and expand

its sphere of greatest national usefulness by giving industry the additional power it needs to increase productivity.

As long-term policy, the development of large gas-producing units at suitably selected points, a number of which must obviously be in areas of dense industrial development in close proximity to coalfields, while others must be at ports where seaborne coal can be cheaply delivered, follows without argument. The rapidity and extent of such development would be governed by permissible capital expenditure reflecting the economic health of the country. Large tonnages of carbonising grades of coal now going to the domestic market, even to industry, would be replaced by coke, and dilution of coking coals by blending augment the tonnages of coke thus produced and eke out our diminishing reserves of good coking coal.

For years the gas industry has argued as to whether its future development should be as a one-fuel or two-fuel industry. The problem of the peak load in gas supply, occasioned by space heating, has been so clearly exposed in recent years by Mr. F. M. Birks and others as to leave no wavering on this matter. It remains that the storage of solid fuel in the consumer's premises provides the only foreseeable solution for meeting the heavy demands of the winter space heating. Having said this, however, I submit that it is not inconsistent to press as a matter of urgency the development work on complete gasification with oxygen at high pressure as initiated by the Gas Research Board and now taken over by the Gas Council's research organisation.

Towards Further Flexibility

Such a development, if successful, would add further to the flexibility of gas-producing technique in so far as it would provide a means of extending gas production to non-caking coals and would appear also to offer a thermal efficiency of total conversion to gas at 80% which is not capable of realisation by present two-stage methods of carbonisation plus gasification. It also avoids the use of imported oil. Complete gasification may well find its application most appropriate in such an industrial area as the Midlands, where suitable coals for treatment are mined and where increasing demand for gaseous fuel for industrial application would result in a considerable out-of-balance condition in the products gas and coke as produced by the orthodox methods of production. Although much has been said against the high cost of associated oxygen plant to serve a complete-gasification unit, which, for optimum economic size, is considered to be in the region of 40 mill. cu. ft. a day capacity, the cost of such oxygen plant is not estimated to be more than that of the installation of standard purifier boxes or towers, which, with purification undertaken by liquid washing, under pressure, would be eliminated.

The power requirements of the commercial oxygen plant could be met to an appreciable extent by pressure reduction of the manufactured gas from 30 atm. to, say, the 3 to 4 atm. pressure required for entry into a district grid system.

There is a greater case for conducting pit-head complete gasification than for carbonisation, because there is no coke to transport, and the estimated low production cost should enable the gas to be transmitted longer distances and sold at a lower price than local production by orthodox two-stage processes. Apart from geographically isolated production units, the move towards the erection of large strategically placed manufacturing centres will impose problems of co-ordination of interests.

Area boards, while remaining suitable territorial units for the purpose of administration and marketing of gas and coke, will in some cases lose much of their self-sufficiency in manufacturing resources, and have to modify their gas-distributing arrangements. There will thus be a greater call for invoking the co-ordination and co-operation of area boards, the Gas Council and the National Coal Board, as provided for in the Gas Act, 1948.

Challenge to the Gas Engineer

The last published accounts of the Gas Council show that the gas industry's overall process efficiency is 74.3% and we know that our newest and largest works can attain figures of 80% and over. If, however, as many outside authorities believe should be done, our gas production efficiency should be expressed on the basis of debiting all our thermal losses to gas production, then the average for all gasworks, again on the basis of the last published figures, is 47.2% with our best stations at 60% or thereabouts. These figures are still more than double the efficiency of electricity production, both on average and best results, but the fact remains, as a great challenge to the gas engineer, that as much as 25% on average, of the potential heat of the coal is needed in producing gas, handling materials, and pumping through to the gasholders. By a simple calculation, it can be shown that if all works were to be brought up to an efficiency of 60% there would be a saving of 3.2 mill. tons of coal per annum. This we can doubtless reach in the course of time, with concentration of manufacture in new plants.

At the present time, and without yet knowing the findings of the Ridley Committee, or what Government action may result, we are faced with increasing restriction on the rate of capital expenditure, coupled with a shortage of constructional materials. The engineer, therefore, is thrown back on an intensified re-examination of the improvements that can be obtained in his existing plant, with particular reference to the reduction in fuel expenditure. With the increased cost of coal, the economic advantages of fuel saving become all the more vital and attractive.

The new organisation of the gas industry has enabled those responsible for production to apply standardised methods of statistical analysis to results, and if those results generally are like those with which I am familiar (and I believe they are) they will have revealed extraordinary anomalies in fuel expenditure, even with works of similar size and plant units. These results can only be explained by the method of plant operation and the extent to which supervision and control have been exercised.

Planned Integration

I have obtained statistics of works in six groups of output to 2,000 mill cu.ft. per annum, as they were prior to vesting date and as they will be when integration plans at *present* proposed are complete. Tables A and B give these statistics. It is considered that works with outputs of 2,000 mill. cu.ft. per annum and over are large enough, when properly designed and operated, to attain optimum high efficiency of gas production.

TABLE 'A'

Size of Works (Mill. cu. ft. per annum)	Number of Works Before Vesting Date	Annual Output (Thousands of Therms)	Coal Carbonised per Annum (Thousands of Tons)
0 to 25	220	16,748	302
26 to 75	224	48,383	742
76 to 150	119	60,902	870
151 to 250	79	70,963	981
251 to 1,250	157	390,372	4,940
1,251 to 2,000	24	174,000	2,066
	823		9,901

TABLE 'B'

Size of Works (Mill. cu. ft. per annum)	Number Remaining after Integration	Annual Output (Thousands of Therms)	Coal Carbonised per annum (Thousands Tons)
0 to 25	153	8,237	136
26 to 75	143	2773	420
76 to 150	62	30,894	384
151 to 250	62	57,925	736
251 to 1,250	127	353,743	4,234
1,251 to 2,000	25	177,590	1,867
	572		7,777

A comparison of the figures gives an indication of the extent to which realistic integration is proposed to be carried out. It is of interest to note that on completion of these

schemes there will still be a by no means insignificant number of small works still in operation, for the reason that they are either too far away from any gas-making station capable of giving an economic bulk supply, or that major renewals or replacements to plant would have had to be carried out before any long-term integration scheme could be made effective.

Selection of Plant

The problem arises now as to the selection of plant that will give increased efficiency of gas production and coal economy, and dealing with each group in turn I would comment as follows:—

Works 0 to 25 mill. cu.ft. per annum

There is little economic future for works in this group with the existing types of plant, and it would seem that those that must remain in commission might well use as their gas-making unit one of the liquid petroleum gas—air plants. If the liquid gas method is extensively adopted, some definite guarantee of adequate and continuous supply on favourable terms must be given by the oil companies. The installation of this type of plant would result in an annual saving in the group of some 136,000 tons of coal.

Works 26 to 75 mill. cu.ft. per annum

The works between these sizes are probably the most difficult to deal with, the carbonising plants being too small to justify complete mechanical handling. They present labour problems and are certainly outside the range of efficient waste-heat recovery. The type of gas-making unit that appears to offer the best prospect is the full use of automatic carburetted water gas sets or blue water gas or producer gas enriched with propane or butane.

However, if sufficient quantities of liquid petroleum gases are available these can be re-formed to a calorific value of 500 B.Th.U. per cu.ft. and oil-carburetted water gas retained as an emergency or for peak load.

Further appreciable quantities of coal would be saved in this group, and the labour problem, including its high cost, eliminated by virtue of the automatic nature of the operations.

Works 76 to 150 mill. cu.ft. per annum

For works remaining in this group, where existing plant cannot be brought up to a modern standard of efficiency, and new plant must be installed, I feel that there is still a sound case for the modern machine-charged 'through' horizontal retort, say 12 ft. long set in beds of six or eight, with Congdon offtakes, supplemented by producer gas or blue water gas dilution. With this size of plant there is scope for normal waste gas recuperation and full waste heat steam recovery, together with mechanical handling of materials. Horizontal plant is to be preferred, since it gives a greater degree of flexibility and requires less technical supervision. The smaller units permit resetting or repairs to be carried out more readily.

Works 151 to 250 mill. cu.ft. per annum

Not until this stage (and I know this may well be a controversial statement) would I consider continuous vertical retorts. Plants of this type in the smaller range have not proved so good in fuel economy and are not so flexible, particularly during resetting and repair work. The cost of refractory renewals, due to their general low life in this system, is a serious disadvantage on the small installation.

Works 251 to 1,250 mill. cu.ft. per annum

Within this range, any type of properly designed carbonising system, with the exception of coke ovens, can, of course, be accommodated. Towards the upper limit further improvements in fuel efficiency could be effected by adopting the pass-out engine or turbo-alternator using waste-heat steam to produce a high percentage of the power required to operate the works, together with sufficient steam to meet all normal process requirements. The extent of the improvement would depend on the type of carbonising plant, and this in turn would be influenced by the class of coal available, local amenities, nature of local coke market, and other such considerations.

Works 1,251 to 2,000 mill. cu.ft. per annum

Here we have an opportunity for high potential output at low capital cost. There is scope for the production of all power requirements from waste heat steam operating through condensing pass-out engines or turbines, sufficient steam being bled off at an intermediate stage to meet process work requirements. Even with existing works of this size, operating with low steam pressures of the order of 100 to 120 lb. per sq. in., much can be done to improve fuel efficiency by the installation of condensing pass-out machines. In the case of new works in this range, steam pressures of the order of 250 to 300 lb. per sq. in. can be adopted with resulting improved fuel efficiency.

Such plant operating in conjunction with non-recuperative continuous vertical retorts can be shown to provide all the power and process steam requirements of the works and surplus electrical power for export to the grid. There are possibilities of using this surplus electricity for the production of oxygen, but this would not be applicable to works in the range now under consideration. As an alternative, one might well consider the adoption of fully recuperative settings, which would show a reduction of the order of 15% in the fuel to producer, but would reduce the steam available per ton of coal to some 55% of that obtaining with non-recuperative settings. In such circumstances it would be necessary to augment the power produced from waste heat steam by generation from solid-fuel fired boilers or by taking a supply of electricity from the grid, and for works coming within the range under review the latter would give a better fuel efficiency figure from a national point of view.

It is clear that every effort should be directed towards the minimum expenditure of fuel and power per ton of coal carbonised, and in this connection attention is drawn to the recovery of coke from pan ash. It has been calculated that the potential saving on a national basis is of the order of 250,000 tons of coke per annum.

As you know I have had the privilege and honour of leading a team representing the British gas industry to the United States of America, under the auspices of the Anglo-American Council for Productivity and the Mutual Security Agency. This team of 16 represented a cross-section of interests on the operational side of the British gas supply industry, ranging from those experienced in administration, engineering science, and industrial relations to plant operators and craftsmen. It was chosen jointly by the Gas Council, which had 10 nominees, and the trades unions, which had six nominees. We spent six weeks on the American Continent, and I believe I am correct in saying that no other productivity team had so extensive an itinerary, covering approximately 10,000 miles, while at the same time undertaking so many visits and assignments. I do not wish to anticipate or in any way prejudice our report, but I have been pressed on every side to take this opportunity of giving a few personal impressions of our tour.

Co-ordination of Interests

Co-ordination of interests in the American gas industry is undertaken by the American Gas Association, which is subscribed to by 95% of the gas utilities, and has affiliated to it the Gas Appliance Manufacturers' Association. Although its laboratories have approved standards for appliances, these standards appear to be dictated not by the technical experts, but by the consensus of opinion of members; thus we found that a number of large undertakings retained their own testing laboratories and applied conditions different from, or in excess of, the requirements of the American Gas Association.

The sales aim is to secure constant turnover; for instance, cookers are expected to be replaced every 10 years, but the useful life is certainly longer. In other words, an appliance does not generally become worn out, but out-moded.

In assessing the marketing value of an appliance in the competitive field, dressy appearance, efficacy, or perhaps I should say automaticity, is more important than thermal efficiency. The electrically ignited burner, clock-controlled, and electrically actuated cooking operations give more leisure to the housewife. Such developments are in line with the automatic gear change of the car, are typical of American life, and demand our attention and our admiration.

The second point in the American scene to which I should like to draw attention is the rapid change-over that has taken place over the last decade from manufactured to natural gas throughout the length and breadth of the country. In 1951 over 90% of the total therms sold by the American gas industry were from natural gas, brought to distributing centres by 109,000 miles of transmission main. These mains are up to 30 in. in dia. and operate up to pressures of 1,000 lb. per sq. in. The Transcontinental Gas Pipeline Company began sending natural gas through its approximately 1,800-mile Texas to New York line during the last few days of 1950, and is the latest of some 17 major pipeline companies. There are now only 12 gas-production centres carbonising coal, and these are all coke oven plants; by the end of 1952, this number will be reduced to five. During our visit, the great Brooklyn Union Gas Company of New York was making the biggest change-over in history directly from mixed coke oven and carburetted water gas of 540 B.Th.U. per cu.ft. to straight natural gas of 1,050 B.Th.U. per cu.ft., and redesigning its existing carburetted water gas plants to function as oil gasification units. These sets, together with liquid butane storage will in future meet demands unable to be met from their present allocation of natural gas, and also act as a standby against trouble on the bulk supply pipeline.

Transformed Economy

This tremendous asset of natural gas has completely transformed the economy of the American gas industry, which in a number of States, particularly those of the eastern seaboard, has been under considerable strain as a result of competition from oil and electricity and the restriction on gas prices as imposed by the State Regulating Committee for Public Utilities. Even in New York, which is at the end of 1,800 miles of pipeline, natural gas can be sold at 25% cheaper rates than manufactured gas, while in other areas, more favourably placed to receive it, it retails at a price that makes it cheaper than coal, oil, or electricity on a gross thermal basis. In these circumstances, the industry has developed its industrial load and its domestic space heating load to an enormous extent.

The sale of gas at cut rates on an interruptible supply basis, sometimes referred to as 'dumping,' has been developed to a high degree with some undertakings, but, judging by what was said at a conference of commercial and industrial representatives at Cincinnati, there would seem to be divided opinion as to the extent to which such a policy should be pursued.

Nevertheless, the principle of selling on an 'interruptible' basis, if wisely used, does improve load factors, and may well have application in industrial areas of this country; for instance, in affording supplies to a priority factory during a temporary shortage of plant capacity when viewed on an annual basis.

Most 'billing' is done on a monthly basis, though a number of large utilities have extended this to the bi-monthly period and the rate is essentially what we know as a block tariff. The first block includes general administration, service and meter rent, and is a minimum charge which must be paid whether the gas is used or not. This is an important point of principle, and has much to commend it, particularly in so far as it takes care of the unremunerative consumer. When the test case for applying such a charge was fought in the United States some years ago, the company concerned was able to show that it was not in the lowest income groups that the bulk of the small unremunerative consumers was to be found.

The next block falls rapidly in price; this is possible because of the low cost of the natural gas bought from the pipeline companies, and this is followed by one or more other blocks falling steadily in price with quantity consumed.

Perhaps the greatest contrast in policy between this country and the United States is in the commercial field. This has been brought out by other observers and is in the extent to which 'contracting out' is employed. The utilities, while maintaining some showroom facilities for displaying appliances, generally do little direct selling. This is left to approved dealers, who also undertake the installation work and the servicing of the appliances. The utility, however, assists with advertising, with the training of dealers' employees engaged in selling and fitting and servicing. It also provides a technical advisory service co-operating with consumer and dealer. There appear to be no strict terms of approval for a dealer, but once appointed he must preserve an adequate standard of workmanship and service. All utilities, however, keep a highly trained mobile force of emergency service men, usually in radio communication with its depôt, to deal with escapes, supply failures, and other dangerous situations. The transfer of selling, installing, and regular servicing of appliances from the responsibility of the company to that of outside agencies has now become almost complete, and the movement appears to have been accelerated with the advance in the use of natural gas.

I gathered, and this was a personal impression, that during the latter days of manufactured gas, servicing costs had been hampering competition, and that here was an opportunity to divorce them from their influence on the gas account. In other words, like the electricity supply undertakings, the gas undertakings settled down to sell primarily their commodity gas, and not gas service. This policy had a desirable effect in another field—namely, that of 'billing' and accounting which could be streamlined and lend itself to the simplest form of machine operation. The absence of prepayment meters and appliance rentals again gives rise to simplification of accounting and organisation.

The extent to which street work or mainlaying is contracted out varies, though generally the bulk of ordinary supply mains is laid and maintained by employees of the utilities. Large feeder and transmission mains are for the most part laid by contracting firms, which have excellent mechanical equipment.

Use of Steel Mains

One of the points upon which we were interested to seek information was that of the possible extension of our use of steel for mains in this country if justification for such use could be found in the States, the aim being to conserve our natural resources of iron, with some saving also in fuel. The picture remained confused for some time, and we had to conclude that there was insufficient evidence to cause us to recommend any general departure from our own established practice of laying mains carrying up to 25 lb. per sq. in. in cast-iron with mechanical joints. For particularly high-pressure work, high-tensile steel has been developed, and interesting technical details were obtained of the natural gas lines and pumping plant.

In the field of distribution, it is interesting to record that most utilities undertake periodic leakage, surveys on their mains systems, and this may, with advantage, find application here. The main and service layer has a wider variety of mechanical tools at his disposal than his counterpart in this country, and thrust boring is quite common practice, particularly with services.

No case of liquid purification of manufactured gas that was not backed up by oxide boxes came within our knowledge. In spite of the sulphur shortage, spent oxide is being dumped. Only at the seaboard works of Koppers Company, Inc., was the hydrogen sulphide which was extracted by their vacuum sodium carbonate process recovered as sulphuric acid in a contact acid plant using a vanadium catalyst. Extraction of hydrogen sulphide was at the rate of 90%. Hydrogen cyanide was also profitably extracted and fixed as sodium and potassium salts.

(Concluded on page 689)

Price Structures of the N.C.B.

Raillery of Sir Hubert Houldsworth

'THERE is increasing co-operation between the National Coal Board and the Gas Council,' said Sir HUBERT HOULDSWORTH, Q.C., Chairman of the National Coal Board, in replying to the toast of 'The Guests,' proposed by the President of the I.G.E., at a luncheon at the Savoy Hotel, London, on May 27. But, added Sir Hubert, some might not suspect the truth of this co-operation if they agreed with what area gas chairmen had to say about coal prices.

'A Repentant Sinner'

SIR HUBERT HOULDSWORTH said how interested he had been in reading a letter by Mr. F. G. Brewer, Secretary of the Gas Council, which was published in *The Times* of May 17. In that letter —though it was written to confute other opinion in the matter of thermal efficiency in fuel usage—Mr. Brewer had said: 'It would perhaps have been more seemly if the several fuel industries had refrained from public discussion of each other's merits and demerits.' It only remained, commented Sir Hubert, to rejoice over one sinner who had repented and to hope that the various chairmen of the gas boards were going to pursue, with as much light as gas would give, the paths of truth.

But, Sir Hubert continued, the N.C.B. was finding much common ground with the Gas Council, particularly in discussions relating to, and the development of, research work. The Gas Council and the National Coal Board had already had discussions together about possible experiments on the complete gasification in a large field of low grade coal. The N.C.B. would welcome the advice of the Gas Council in this regard. The N.C.B. was also discussing with the Gas Council experiments on the blending of coal for gasworks and the utilisation of methane in the national interest —which, after investigations, might or might not relate the gas industry to the national interests in the use of methane. Apart from this the N.C.B. was happy to know that the Gas Council had joined in membership of B.C.U.R.A. These were healthy signs. They were signs which ought to exist between two great industries devoted to a national purpose.

Influence of Leeds University

DR. E. D. ADRIAN, O.M., M.D., D.SC. (President of the Royal Society) proposed the toast of 'The Institution of Gas Engineers.' In doing so he remarked that for nearly 90 years the gas industry had been encouraged and regulated and organised by the Institution of Gas Engineers, which had encouraged technical developments of all kinds by bringing the senior men together to discuss their problems and had trained the junior men in the special branch of engineering they had to learn to become competent. The engineering institutions in general had guided and set the standards of much of the professional training and had co-operated with the universities in looking after the more academic side of it and in conducting research in some of the specialised branches. The development of the laboratories of coal gas and fuel engineering at the University of Leeds had been an outstanding example of this co-operation. They might hope that the new departments of chemical engineering which were starting at several universities would have valuable results of the same kind. After all, it would make for enlightened engineering if the best men had the best general training to start with and had rubbed shoulders with lawyers and historians and pure mathematicians, and it would certainly make for a more enlightened public if university men generally could go out into the world not entirely ignorant of industrial problems and processes. No one doubted the value of a technological university for specialised training, but nowadays there were so many technologies that one felt that in the end a university of technology would be very little different from any other.

The Urge to Experiment

'One would like to be able to experiment,' said Dr. Adrian—'to develop the colleges of technology in parallel with really first class university departments and to run them in the sort of competition that always makes for scientific advance. The trouble is, of course, that experiments in scientific education must be rather like some experiments in engineering. They need very costly apparatus and take a long time. And in the end I expect we should find that both kinds of training have their advantages and that the result is going to depend much more on the men in charge than on whether the student comes to them as a member of a university or as a technologist. The result will depend a great deal on the sort of research that is going on parallel with teaching.'

MR. G. E. CURRIER, O.B.E., President Elect of the Institution of Gas Engineers, responded to the toast. He remarked that the Institution was small numerically and was highly specialised. Nevertheless, they were very proud of their Institution, the membership of which was increasing. The standard required for admittance to corporate membership was being raised, and the rate of subscriptions was also being raised. They could, he thought, justly claim to be enterprising, energetic, and efficient; and they continued to carry out their main object—namely, the promotion of the general advancement of the industry in all its branches, the study of gas science, and the facilitating of the exchange of information and ideas on subjects connected with that science. Doubts were sometimes expressed as to whether they were getting the best type of young men as entrants to the industry. One of the difficulties was that the industry was not sufficiently well known to students who were considering their choice of a career. It might be that the gas industry had not been assertive enough.

A Nice Gesture

While deputising for the President he had been impressed by the enthusiasm of the members in the provinces and by the excellent support given by the area boards to the district sections of the Institution. He had also been impressed by the comment of Mr. Mervyn Jones, Chairman of the Wales Gas Board, regarding the submission of a paper by two of his senior officials. Mr. Mervyn Jones had said there was no need to ask for sanction to give the paper—it was a personal matter between the officials and the Institution. That was a very nice gesture which would be much appreciated.

SIR JOHN STEPHENSON, C.B.E. (Chairman, Eastern Gas Board) proposed the toast of 'The President.' In doing so he commented that his association with Mr. Dyde had been on the business side but Mr. Dyde's personality was such that it was impossible to regard any association with him purely in a business way. Mr. Dyde's energy and enthusiasm for the gas industry knew no bounds. The future of the industry —and, indeed, the culture of the country —were in safe hands if they could ensure men of the calibre of Mr. Dyde.

S.B.G.I. Golf Circle

ACCORDING to custom the Summer Meeting of the Society of British Gas Industries was held on the Monday of Institution Week, this year on the course of the Roehampton Club. The competitions included that for the Coronation Plate, played for by the visiting members of the Institution of Gas Engineers.

There was again a very full attendance, but all the arrangements worked admirably under the direction of the Hon. Secretary, Mr. W. Morland Fox, and an energetic Committee.

The results were as follows:—

Thornton Cup.—Winner: Chas. Cooper. Runners-up: J. C. Woodall and C. A. Macleod.

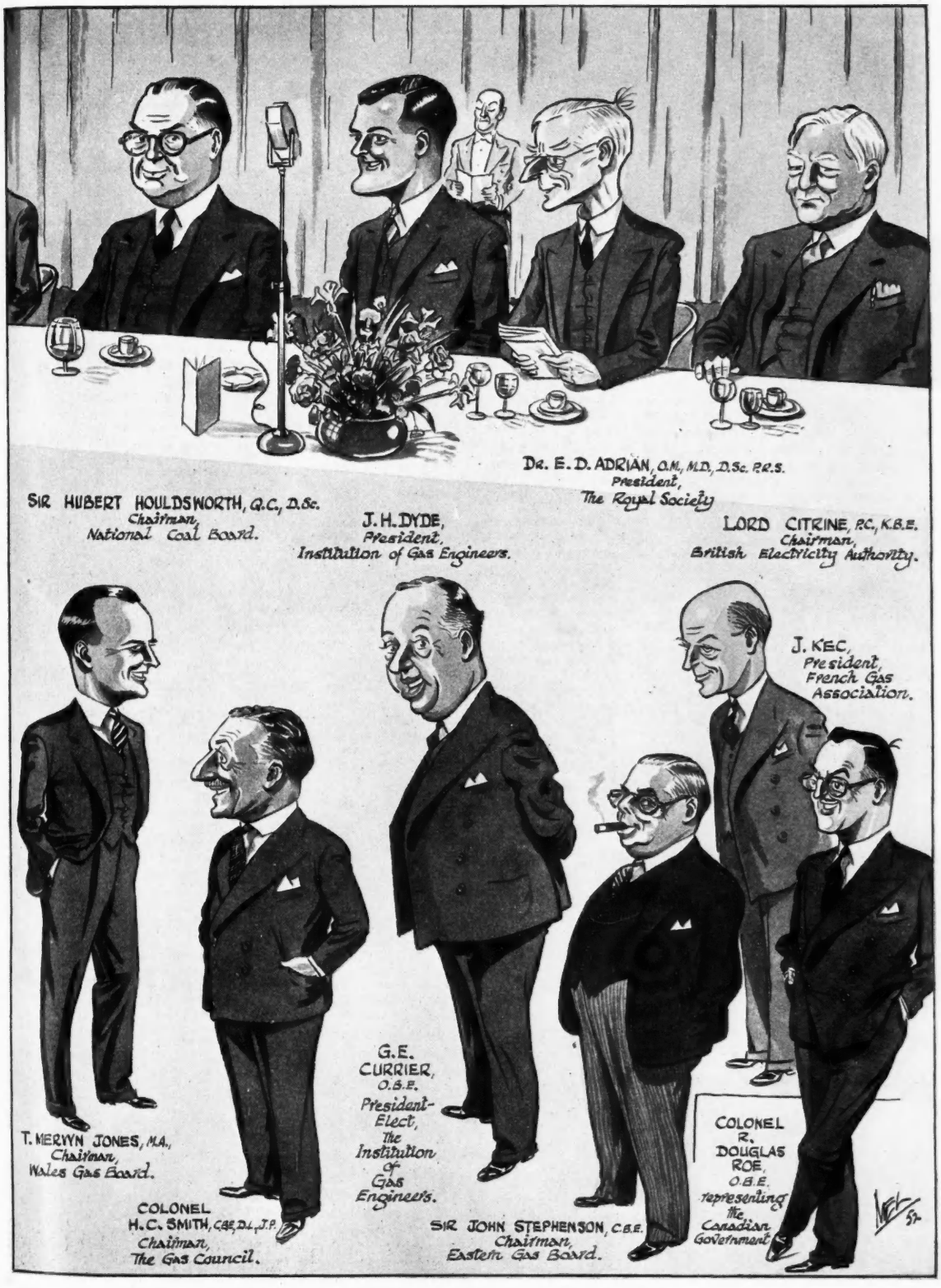
Coronation Plate.—Winner: J. Denton. Runner-up: H. C. Dunbar.

Visitors Prize.—Roy Slipper.

Foursomes.—1st.: J. B. Clay and J. H. Race, 3 up. 2nd: Darrell Rees and S. C. Thomson, 1 down. 3rd: I. M. O. Hutchison and O. P. Cronshaw, 2 down.

Scratch Prize.—C. A. Macleod (79).

Our photographs of the occasion appear on page 685. They include a personality on whom Bill McGowran recently (May 23) threw the searchlight of his *Evening News* diary, quoting arithmetic to prove that he and his caddy have in 22 years covered 7,500 miles in pursuit of the elusive golf ball. But in Arthur Docking's case it rarely eludes him.



Personalities at the President's Luncheon at the Savoy Hotel on May 27 as seen by 'Mel.'

Colonel W. R. Glover presenting replica of original snuff box to Mr. J. H. Dyde.

VISIT TO GLOVER AND MAIN, LTD. GOTHIC WORKS, EDMONTON, MAY 28

ON Wednesday, May 28, some 300 members of the Institution and their ladies visited Gothic Works, Edmonton, and saw the factories of Glover & Main, Ltd. The visitors were led by Mr. J. H. Dyde, President of the Institution, and included, among others too numerous to mention, Col. H. C. Smith (Chairman, Gas Council), Mr. T. Mervyn Jones (Chairman, Wales Gas Board), Mr. A. McDonald (Chairman, Manchester & District Section, I.G.E.), Dr. H. Hollings (Controller of Research, North Thames Gas Board), Mr. A. Henshall (Deputy Chairman, North Western Gas Board), Mr. D. D. Burns (Deputy Chairman, Scottish Gas Board), and Mr. B. Paulson (President, Norwegian Gas Association). The following Members of the Council of the Institution also were present—Mr. T. C. Battersby, Mr. W. O. Kirkwood, Mr. D. D. Melvin, Mr. J. Powdrill, Mr. E. G. Smith, Mr. W. K. Tate, Mr. F. K. Thomas and Mr. A. Tran; and the Secretary, Dr. W. T. K. Braunholtz. To greet their guests on this occasion were Colonel W. R. Glover, C.M.G., D.S.O. (Chairman, Glover & Main), Messrs. P. D. M. Aird (Vice-Chairman, Glover & Main), A. W. Smith (Director, Glover & Main), S. Wilson (Deputy Managing Director, Thomas Glover & Co., Ltd.), C. Marley (Joint Managing Director, R. & A. Main, Ltd.), C. A. Macleod (Sales Director, R. & A. Main, Ltd.), Dr. B. K. Nicklevsky (Director, Main Enamel Manufacturing Co., Ltd.), and Mr. D. Syme (Director, Thomas Glover & Co., Ltd.).

Tour of Twenty Four Acres

This was a busy afternoon, for the Glover & Main site embraces 24 acres, and the factories of Thomas Glover & Co., Ltd., R. & A. Main, Ltd., and the Main Enamel Manufacturing Co., Ltd., extend to over 677,000 sq. ft.

Since the members of the Institution last visited Gothic Works in 1938, considerable development and redeployment has taken place. The ravages of the war years—no fewer than seven H.E.'s, two V.2's and sundry incendiaries fell on the site and caused much damage—have been made good. Extensive mechanisation, notably in part of the foundry, has been introduced, and the Main Enamel factory has been erected.

Particularly noticeable was the high general standard of the working conditions throughout the factories, the spaciousness of the shops and the excellence of the lighting and ventilation. Welfare facilities at Gothic Works are admirable—the special ablutions adjacent to the foundry being a model of their kind and thoroughly appreciated by the men.

Redeployment

The redeployment of the shops in the R. & A. Main factory into four main groups in relation to N to S and E to W gangways expedites progress of work from shop to shop and facilitates all stages of processing. The foundry group comprises the pattern, fettling, grinding and drilling shops; the press shop is grouped with its ancillary shops; the enamel group comprises the enamel shop with the shot blast and mill room; and the fitting shop is grouped with the various stores and despatch warehouse. The enamel shop, now one of the largest under one roof in the country, contains a most impressive range of up-to-date equipment.

In the works of Thomas Glover & Co., Ltd., we saw the extensive tin shop with facilities for 140 tinmen. The firepots in this shop are served by a high-pressure gas service and consume some 5¼ mill. cu.ft. of gas annually. A special exhausting system serves the dual purpose of removing the fumes, and changing the air entirely every 20 minutes. In the large industrial meters section of the tin shop meters having capacities of up to 50,000 cu.ft. per hour were seen in various stages of assembly, and mechanical and non-mechanical oiling devices were seen being put together. In the general section of the tin shop the meters under construction varied from the D.1 (100 cu.ft.) to the smaller industrial types of 1,800 cu.ft. The preliminary testing for soundness of diaphragms and outlet channels, in the domestic range of meters, is also carried out here.

In the automatic machine department many single spindle automatic machines are constantly employed in the production from brass bar stock of components which are required in large quantities. The auto general department was engaged in the production of yet more components, chiefly from brass rod. Capstan and turret lathes, as well as automatic gear-hobbing machines, were in use, and special purpose machines, ranging from single-spindle sensitive drillers to the six-spindle type, drilling holes in the prepayment movement frames. Here, too, hand presses and milling and tapping machines are used, and the assembly of the prepayment mechanisms and price-changer plates was seen.

Completed in 1951

The factory of Main Enamel Manufacturing Co., Ltd., a bright and spacious building, was completed in 1951 and, with its single span construction and northern lights, is excellently suited to its purpose. We saw how the raw materials are received at the loading bay and, with a minimum of handling, are conveyed by a bag elevator to the storage gallery. At the front of this gallery were seen the storage hoppers from which the ingredients required for the manufacture of enamel frits, the basic ingredients of all vitreous enamels, were fed direct into dual purpose weighing and mixing containers, carried on a

G.J. 4388

G.J. 4392

cradle running on a track below the hoppers.

From the weighing cradle we saw the container lifted by overhead tracked hoist to a mixing cradle where the ingredients were to be thoroughly mixed, by rotation, for 15 min. Time did not permit of our seeing this particular batch through all its stages of processing, so we went on to inspect the oil-fired smelters to which the batches are conveyed, again by overhead hoist, after mixing.

The Final Stages

Following smelting for about 2½ hours at a temperature of 1,100°C., the resulting material, then in a state not unlike molten glass, is poured off into the water tanks below and quenched. The final product is frit. After quenching this frit is placed in bins, coupled to electrically heated hot-air blowers, and dried. After drying the frit is ready for weighing, bagging, and despatch.

The new factory of the Main Enamel Manufacturing Co., Ltd., the first works of this kind to be visited by members of the Institution, is unique in that it not only supplies enamel frits and oxides to the G. & M. group of companies, but also meets the requirements of other manufacturers both in Great Britain and in export fields.

Continuing, we came to the last of the three separate works on the site, the factory of R. & A. Main, Ltd. First we entered the core shop, wherein we saw, in various stages of preparation, some of the many types of core used in the works foundries. The cores are moulded and then conveyed on special racks through a thermostatically controlled continuous gas-fired oven, consuming 30 cu.ft. per min., where they are baked at 250°C. for a period of just over one hour. The mechanical foundry has an area of 22,000 sq. ft. Typical of the care which governs all stages of production is the attention given to the reconstitution of the moulding and after use for casting and before it is re-used.

Floor Foundry

The floor foundry, next on our route, has an area of 50,000 sq. ft. with accommodation for over 3,000 moulding boxes. It is used primarily for cored work and castings required in smaller quantity than would prove economic on the mechanised plant.

Replica of the original snuff box of 1856.

We passed on to the shop which deals with all parts to be finished in paint. Of special interest was the oil-fired continuous dipping plant, thermostatically controlled to maintain a temperature of 400°F., which dips the parts into the paint, drains them to remove any surplus, and stove-finishes them. The output of this plant is some 60,000 pieces a week, and the full cycle takes approximately two hours.

The Fitting Shop

In the fitting shop cookers and fires are assembled, tested, inspected, and wrapped prior to despatch. The attention of most of us was held by the No. 20 cooker assembly line—26 operations are carried out on the conveyor belt system in an average time of 3 min. for each operation. Material supplies permitting, the output of the line is 200 cookers. Other cookers are assembled on both line and individual methods. Also in the fitting shop was seen the assembly of heavy-duty catering equipment, which special apparatus represents a potential load of considerable importance to the gas industry.

In the enamelling shop we saw, among other equipment, the continuous cast iron drier dealing with the output of 16 operators working at eight spraying booths, the battery of five 15 ft. Dresler box muffles used for the fusing of both cast and sheet iron, and the 'Ferro Junior' continuous furnaces.

A carefully planned itinerary ensured a most interesting visit, and while it was obviously impossible to see all the many processes that contribute to the manufacture of meters, cookers, fires, and the production of enamel frits, nevertheless it was a most interesting and informative tour.

Tea and refreshments followed the works tour and in the course of his welcome to the visitors, Col. W. R. Glover said that it gave his company, board, staff and employees, the greatest pleasure to be honoured by this visit of the Institution members and their ladies, and he hoped they had had an interesting tour of the works.

A Thrilling Experience

'We have had a close link with the Tottenham Gas Company since 1898 and in 1900 moved from our Clerkenwell works to the new works at Tottenham which had been built by John Aird the year previously. In 1938 the energetic young President of the Institution, Mr. H. C. Smith, then of Tottenham, suggested an innovation—that we should open our works to a visit from the Institution. This we did and it proved to be a thrilling experience. We are again delighted to show our works and processes today, although we regret that we cannot show you a large new mechanised extension and reorganisation in the Thomas Glover & Company's stores and a new research block for R. & A. Main which we had hoped to have completed, but which we now hope to start in the second half of this year.

Now, Mr. President, we really think this occasion deserves a memento. We have had a replica made of our most treasured possession, the history of which is as follows. In 1856, some 30 years after our foundation, the firm's employees presented my grandfather, Thomas Glover, with a Coaster Snuff

G.J. 4387

G.J. 4384

G.J. 4395

Box. On the lid is inscribed "August, 1856, Presented to Mr. Thomas Glover by the workmen in his employ as a slight mark of their esteem for his kind, candid, and considerate manner he has at all times acceded to their wishes either individually or collectively." Even in these difficult times we hope we have maintained the tradition. You will be interested to know that the carving, toolwork, etc., was originally done by George Adams, and Messrs. Dodd & Sons, who were the old East Indian Company's silversmiths, have employed the successors of George Adams to repeat the same work on the new snuff box, the inscription on which reads, 'Presented to the Institution of Gas Engineers during the Presidency of J. H. Dyde, Esq., on the occasion of their visit to Glover & Main, Ltd., Gothic Works, Edmonton, 28th May, 1952. Replica of original box presented to Thomas Glover in 1856." On behalf of Glover & Main, Mr. President, I ask you to accept this small memento of this occasion with the hope that it may be used at your Council meetings and on other special occasions to harbour and cement the friendliness and good fellowship which has always been an outstanding feature during the whole existence of the Institution and the Industry as a whole.'

In reply Mr. J. H. Dyde said how much he appreciated the honour of being called upon to accept this gift to the Institution. 'It is, if I may say so, a somewhat enigmatic present, not to be sniffed at, and yet to be properly appreciated we must sniff. I would say now that in future a qualification for membership of our Council will be that one should take snuff.

Significant Wording

'It is a great pleasure to receive this present during my year of office, and I am especially pleased that inside the box is inscribed the wording as on the lid of the original—wording which has special significance. What a fine example of Industrial Relations in the Nineteenth Century! One other feature of the box is also significant; even a hundred years ago Glover & Main went in for mechanisation, as the wheels on the box show.

'As you said, Colonel Glover, it was under the Presidency of the present Chairman of the Gas Council that the first visit of a party from the Institution was made to these works. To carry on the connection, how could I do other than make my first choice the same? You go to such lengths to make our visit both fascinating and memorable. Coming back but recently from the United States of America, I had been impressed by the many brochures I had seen, and now to confound me completely, this excellent brochure prepared by Glover & Main as a souvenir of this visit, puts anything I saw in the States in the background. It has been delightful to enjoy your hospitality and to be conducted around your works. This visit is one to be long remembered. Finally, may I thank you once again for this lovely memento, a treasure which will be prized by the Institution.'

Two Visits to Ponders End Gasworks

'A Good Engineering Job'

THE last complete gasworks to be inaugurated before nationalisation was that of the Tottenham and District Gas Company at Ponders End and the two visits during Institution week were among the major events in the programme. When the inauguration took place nine days before vesting day Colonel H. C. Smith, now Chairman of the Gas Council, was Deputy Chairman of the Tottenham Company; today Ponders End is the show place, though not the largest works, of the Eastern Gas Board, of which Mr. J. H. Dyde, the Institution President up to May 29, is Deputy Chairman.

The original works built by the Ponders End and Enfield Highway Gas Company in 1859 has been demolished and a complete and entirely new works took its place by the following stages: Design commenced June 1, 1944; first contract placed October 19, 1945; work on site commenced December 1, 1945; gasmaking (first half) January 3, 1949; official opening April 21, 1949; gasmaking (second half) September 26, 1949. Of the previous plant only three small manually-operated water gas plants remain; these are not normally operated but are retained for emergency use and will later be replaced by a new unit of 8 mill. cu.ft. per day capacity.

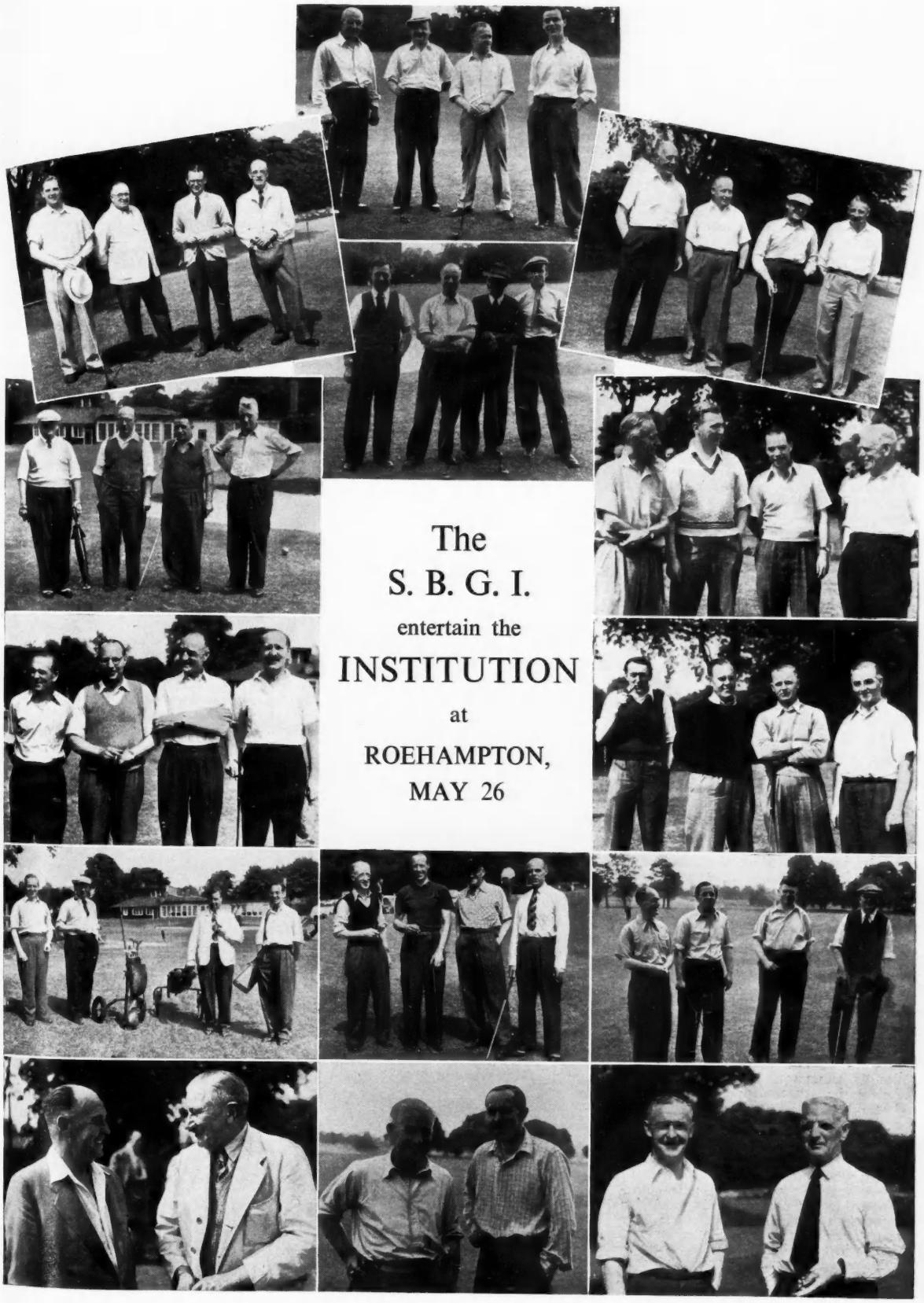
G.J. 4403

One of the parties of visitors touring the Ponders End works.

The works, fully described in the *Journal* of April 27, 1949, has a rated capacity of 7.5 mill. cu.ft. per day and provision is made for the new water gas plant mentioned. The works is designed architecturally as a whole and every effort has been made in design and operation to provide a gasworks giving clean conditions inside and avoiding disturbance of public amenities.

There were about 150 visitors on the Wednesday afternoon and a slightly larger number on the Thursday. On both occasions the tour of the works was followed by tea in a large marquee, after which Mr. F. T. Brookes, Divisional General Manager of the Tottenham division, who apologised for the absence of Sir John Stephenson, Chairman of the Board, extended a warm welcome to the guests. Speaking on the second occasion, Mr. Brookes described the Ponders End works as a monument of private enterprise designed in the old Tottenham Company's own drawing office.

Mr. J. M. Webber, on the first afternoon, voiced the thanks of the visitors to the Eastern Gas Board, its officers and staff. On the second visit Mr. E. Crowther, Chairman of the Northern Gas Board, expressed the visitors' thanks. He said he had been a shareholder of the former Company and he was proud to have been associated, even in that small way, with the development of so fine a works. Gas engineers present would agree with him that Ponders End was a good engineering job.



The S. B. G. I. entertain the INSTITUTION at ROEHAMPTON, MAY 26

THE INSTITUTION VISITS . . .

. . . Gasworks, Factories, Places of Scientific Interest—and Purely Social

FUEL RESEARCH STATION

ONE of the alternative visits on the Wednesday afternoon was to the Fuel Research Station at East Greenwich, where members saw selected items of the research programme, including the investigation of atmospheric pollution, domestic heating research, combustion chambers for coal-fired gas turbines, and the removal and recovery of sulphur compounds from flue gases.

On the carbonisation side, research is proceeding on the production of metallurgical coke in intermittent vertical chambers and on various gasification problems, including the use of radio-active tracers.

The tour was novel in the sense that it was unconducted. In other words, the visitors were entirely free to wander around just as they wished and with the help of clearly marked buildings in conjunction with a key plan were enabled to inspect those items in which they were particularly interested and by-pass those in which they were not. In each department members of the staff were waiting to explain the items in their particular section. A buffet tea was provided by the courtesy of the Department of Scientific and Industrial Research, and Mr. G. E. CURRIER (President-elect) voiced the thanks of the Institution for a most interesting visit. It was the practice on the occasions of their annual meetings, he said, to visit gasworks, the works of plant manufacturers, as well as places of highly scientific interest; their visit to the Fuel Research Station fell into this last category.

Dr. A. PARKER, C.B.E. (Director of Fuel Research) thanked Mr. Currier for his remarks and said what a pleasure it was to have the Institution of Gas Engineers with them that day. He assured them that the Fuel Research Station was 'at their service' at all times, and if any member or group of members desired to make a special visit to study some particular aspect of research they would be most welcome.

FULHAM LABORATORIES

AT the invitation of the North Thames Gas Board members had the opportunity on the Thursday afternoon of visiting the Fulham Laboratories where many phases of gasworks research are continuously proceeding under the able direction of Dr. H. Hollings, who, as recently announced in the *Journal*, will shortly be succeeded by Dr. R. H. Griffith.

Members saw exhibits relating to a new design of gas calorimeter, the magnetic oxygen analyser, a safety device for use with electrical precipitators, spray suppression in cooling towers, and artificial oxide for purifiers. Of particular interest are experiments in the use of a radio-active tally in retort house surveys, which will assist in the solution of many problems concerning the travel of coal through continuous vertical retorts.

At the conclusion of the tour of inspection a large party of members sat down to tea in the well-appointed works canteen, when Dr. HOLLINGS expressed the regret of the Chairman and Deputy Chairman at their unavoidable absence, in whose place he was charged with the pleasant duty of welcoming them to Fulham. It had been a very great pleasure to the staff to show them what they were doing in the research laboratories.

Mr. J. M. WEBBER, on behalf of the visitors, asked Dr. Hollings to convey to the Board the sincere thanks of the Institution for the opportunity of visiting Fulham. The number of members present spoke more eloquently than he could in that respect. The predominant note was the intensely practical nature of the work; it all had a direct bearing on what they were doing on the gasworks every day. Mr. Webber also thanked the guides.

RICKMANSWORTH

ONE of the six alternative visits on the Thursday afternoon was to the large and recently-opened sewage works of the Colne Valley Sewerage Board at Rickmansworth, which serves a wide area in the Colne Valley district of Hertfordshire.

The sewage dealt with is mainly domestic, but there is also a large variety of trade wastes including gasworks effluent, brewery, printing, paper making, and food processing wastes, together with effluents from engineering processes. Treatment includes grit removal, sedimentation, biochemical purification by activated sludge using diffused air, digestion of sludge in heated tanks with collection of methane, and disposal of surplus activated sludge by vacuum filtration and flash drying.

ROYAL FESTIVAL HALL

EVEN those gas engineers who had the opportunity of visiting the South Bank Exhibition during the period it was open last year probably did not get a chance of looking behind the scenes at the elaborate gas installations which contributed, largely unseen, to the success of the exhibition. This omission was made good so far as the permanent installations are concerned by a visit to the Royal Festival Hall on the Thursday afternoon, when members inspected the gas heating system which is one of the largest in the country.

Reference to the *Journal* of April 25 last year will tell our readers all about the heating services in the Concert Hall.

At the conclusion of the tour of inspection, tea was provided by invitation of the South Eastern Gas Board, which was responsible for the gas services on the South Bank site.

SHREDDED WHEAT COMPANY

READERS of the *Journal* will have noted from time to time references in our columns to the industries of Welwyn Garden City. By no means least of these—and, indeed, the largest individual gas consumer—is the Shredded Wheat Company, Ltd. This well-known firm is justly proud of the purity and cleanliness of its factory and surroundings which surely provide a living and permanent advertisement for gas.

On the Thursday afternoon the members of the Insitution and their ladies

(*Concluded on p. 729*)

A group of members at the Fulham Research Laboratories.

Abstract of Comm. No. 404

The Gas Industry in France

by

J. KEC,

President of the Association Technique de l'Industrie du Gaz en France.

AFTER the war, the Nationalization Bill, of April 8, 1946, was passed. It gathered together in one single entity the 546 undertakings existing in 1946 and distributed among 200 different concessionary companies. The 290 very small works—that is to say, more than half the total—represented less than 4% of the total production of gas, which shows the enormous number of works remaining in their original state which Gaz de France has inherited. With all works, large or small, henceforth placed in the hands of a single management, consideration could be given to the complete reorganisation of the structure and a national plan of modernisation, which is the work of the Direction de l'Equipement de Gaz de France in accordance with the Coke and Gas Commission of the Monnet Plan (General Plan for Equipment in France).

It was found both possible and desirable to set out the general outline of the programme as follows:—

(1) To aim at the production of metallurgical coke suitable for industrial use or for smelting. (The Schuman Plan gave a new interest to this position, taken up since 1947).

(2) To increase by stages production capacity for gas and coke, and to study present-day markets, taking into consideration the possibility of doubling sales as compared with pre-war.

(3) To reduce from 546 to 290 the number of works in operation, the distribution system of works closed down being fed either by long-distance transmission mains (60 to 250 miles) or by entirely new methods of production from residuals of the petroleum industry.

(4) To make a reduction in the effective strength of personnel, production being improved to a point at which the tonnage carbonised per workman and per annum should increase from 233 tons (1939 figure) to 483 tons once the programme has been achieved.

The concentration of production in a small number of large mechanised works (from which important transmission mains will radiate) is not an obstacle to the large-scale employment of increasing volumes of natural gas available in the South Western Region, nor to the utilisation of surplus gas from colliery or metallurgical coke ovens.

The whole programme can be summarised as follows:

	Situation in 1946 (per annum)	Planned Objective (per annum)
Number of works in operation having a production of:		
More than 10 mill. cu. m. (353 mill. cu. ft.) ..	27	33
From 5 to 10 mill. cu. m. (176 to 353 mill. cu. ft.)	24	55
,, 2 to 5 mill. cu. m. (71 to 176 mill. cu. ft.)	59	80
,, 1 to 2 mill. cu. m. (35 to 71 mill. cu. ft.) ..	71	70
,, 500,000 to 1 mill. cu. m. (18 to 35 mill. cu. ft.)	75	25
Less than 500,000 cu. m. (18 mill. cu. ft.) ..	290	—
	546	263
Number of undertakings supplied by propane ..	10	145*
Coal carbonised (metric tons)	4,237,000	8,170,000
Number of workpeople employed on production ..	18,214	16,750†
Coal carbonised per workman per annum (metric tons)	233	483
Volume of gas sent out (expressed as gas at 4,500 cal. per cu. m.) (473 B.Th.U. per cu. ft.):		
Mill cu. m.	2,300	3,600
Mill cu. ft.	81,227	127,126
Possible production of—		
Metallurgical coke (metric tons)	370,000	2,865,000
Hard coke (metric tons)	70,000	160,000
Gas coke (metric tons)	1,100,000	1,465,000
	1,540,000	4,490,000

* To these figures must be added the future supplies by propane.
† The reduction in personnel which could be effected in the organisation by the merging of certain departments is not taken into account.

New Methods of Production

The two principal ideas concern the improvement of coke quality and the employment of French coals, and especially the dry splint coals of the Lorraine Basin. They have resulted in:—

(*a*) The tendency in gasworks generally to adopt the technique of crushing and blending coals, which before the war was only practised in coke oven plants.

(*b*) The focusing of new methods of crushing and blending, or the study of techniques already known but incompletely explored.

(*c*) The introduction of complete-gasification plants producing either a diluent gas or gas distributable after carburation.

Gaz de France regards as increasingly important the growing use of propane from the petroleum refineries. The uses now put to the test are:—

(*a*) *Producer Gas or Water Gas Enriched by Propane*

The enrichment of producer gas at 1,200 cal. per cu. m. (126 B.Th.U. per cu.ft.), or of water gas at 2,600 cal. per cu. m. (273 B.Th.U. per cu.ft.) by a simple addition of gaseous propane at 24,000 cal. per cu. m. (2,526 B.Th.U. per cu.ft.) results in a gas of 4,200 cal. per cu. m. (442 B.Th.U. per cu.ft.), which can be mixed up to 15% with normal coal gas. It is impossible to go above this in view of the high specific gravity of the mixed producer gas and propane or water gas and propane or water gas and propane. With this system, however, the productive capacity of a works can be increased by 15% with the minimum outlay, or the variable calorific value of gas received from varying works (from synthesis works or coke oven plants) controlled as in the case of certain gas undertakings in the North of France.

One installation of this kind has just been put into service at the coke ovens at Gennevilliers (Paris); the first prototype has been in operation at Loos, near Lille, for about a year.

(*b*) *Distribution of Pure Propane*

When an old distribution system is to be completely renewed (which is the case in certain small works), it is worth considering the distribution of pure gaseous propane, which can be done with steel tubes of small diameter laid at shallow depth and at a small installation cost; it is necessary, however, in this case to change all the services, meters, and appliances.

Certain new experimental systems that were established on the eve of the war have proved entirely satisfactory.

(*c*) *Propane-Air*

When a gas supply serving a small locality has a distribution system in good condition, and if it is not economical to link it to a bulk supply main, it is an advantage to replace the gas, troublesome to produce in these circumstances, by a mixture of propane and air, the production of which necessitates no other manual labour than the bringing in each week of a container of propane. The appliances can be retained, but their burners require modification.

Installations of note are in service or in course of erection at Nangis, Mormant (Paris Region), Falaise (Normandy), Langeais (Touraine).

(d) Cracked Propane

In 1952, Gaz de France will try out on a small scale, at Maintenon (near Paris) an automatic installation for the cracking of propane by partial combustion in the presence of a catalyst. The anticipated advantage of the system is that it will produce a gas that can be substituted for town gas without any other difficulty than that of checking or improving the regulation of appliances.

A great number of small isolated works, far from the proposed route of the transmission mains, will be progressively replaced by the distribution of pure propane, or propane—air or cracked propane; new solutions which, thanks to the fact that the manual labour required is greatly reduced or practically *nil*, ought to ensure financial equilibrium to these small undertakings.

Finally, research is in progress on the replacement of carburetting with gas oil in the complete gasification plant at the pilot works at Vierzon by the addition of cracked propane, which will ensure at the same time the enrichment of the whole of the gas and an increase in the capacity of the works.

Natural Gas

Natural gas contains about 92% of pure methane with a calorific value of 9,600 cal. per cu. m. (1,010 B.Th.U. per cu.ft.). With distribution systems in perfect condition, it can be distributed neat, like propane, but the adaptation of appliances is in most cases impossible or difficult.

Various processes for using natural gas are being studied and tried:—

(i) Cracking by passing through water gas generators.
(ii) Cracking without a catalyst in the presence of water vapour. (Courriers-Kuhlmann system; Kellog system; Hercules-Powder system.
(iii) A catalytic process in the presence of air. (Hercules system.)
(iv) A surface-combustion process. (Licence from O.N.I.A.)

In each case, the process must start with endothermic reactions necessitating the application of heat to dissociate the molecules of methane (CH_4) and obtain a gas formed by mixing the products of cracking with uncracked natural gas. The reactions give carbon monoxide and hydrogen.

The optimum calorific value seems to be about 5,500 cal. per cu. m. (580 B.Th.U. per cu.ft.) and corresponds to a gas which can be distributed without any special modification to appliances.

DISCUSSION

Mr. G. E. Currier, O.B.E. (Senior Vice-President), said they were indebted to M. Kec, President of their kindred Association in France, for the presentation to the meeting of his fascinating account of the changes in, and the development of, gas production and supply in France since the industry was nationalised in 1946; and they congratulated Gaz de France on the rapid progress made by the industry since it had been nationalised. It was inevitable that comparisons would be drawn between the rate of progress in France and in Great Britain, but it must not be overlooked that in this country nationalisation came three years later than in France. The development of the nationalised gas industry in France had evidently been along similar lines to those pursued in Great Britain. France had eight gas divisions corresponding to their own 12 area boards. In each division a policy of integration had been established with small undertakings linked to the larger ones by trunk mains, facilitating the closure of the former. It was noted that for long distance mains the French industry favoured the use of solid-drawn steel tubes welded *in situ*. Those mains were designed to distribute gas at pressures which appeared remarkably high, accustomed as they were in Great Britain to thinking in terms of operating pressures of 50 to 60 lb. to the sq. in. The designed pressure was 570, the tested pressure 850 lb. per sq. in. One would like to ask what had been the optimum pressure used to date, the amount of leakage, and the anticipated life of the mains.

A point which struck one in M. Kec's paper was the emphasis on the use of coke oven gas. The paper referred again and again to the erection of new coke oven plant, rarely to the completion of new retort plant. In Great Britain, coke ovens were in production in the areas of nine gas boards, but they provided less than 12% of the total gas available for sale. In France it would appear that coke ovens provided more than 50% of the gas sold. Some of the British coke ovens were operated by the gas boards, but gas was also purchased from ovens owned by the National Coal Board, by the steel producers, and by private companies. It would be interesting to know something of the ownership of the French coke oven industry and the outputs of gas from the different types of plant.

The French gas industry, in dealing with the many post-war problems associated with shortages of plant and rapidly increasing demand, had had an advantage over Great Britain in being able to bring into use a greater variety of raw materials for the manufacture of town gas. M. Kec dealt with several new processes using petroleum products for gas production. In this country there would soon be five major oil refineries in operation with an annual capacity of 26 mill. tons of crude oil. He felt that there was scope for the development of oil processes in this country, particularly if they could be assured of a more stable price structure than obtained before the war.

The inter-linkage of small works in the country districts of Great Britain was in many cases quite uneconomic, and they must seek other means of manufacturing gas to replace the coal gas produced in the old, inefficient plant at such works. Two plants, one French and one American, for the production of a butane-air mixture had been installed at a small Welsh undertaking, in an attempt to solve this problem, and they were giving very satisfactory results.

Enrichment with Butane

He was interested to note that in France experimental work had been carried out on the enrichment of producer gas and water gas with propane. In Yorkshire the North Eastern Gas Board had installed a Humphreys & Glasgow automatic blue water gas plant at a medium-sized works, with equipment for enriching the water gas with butane, the capacity of the plant being 250,000 cu.ft. per day. The plant had operated for more than a year and had produced more than 20 mill. cu.ft. of mixed gas of 450 B.Th.U. The operation of the plant was fully automatic and required only the occasional attention of one man per shift; at works making less than 20 mill. cu.ft. per annum only one shift per day needed to be worked. The plant design provided for dismantling and transfer to a small works and this would be done as soon as the experimental work was completed. The gas produced was very similar in characteristics to normal town gas and could be used in standard appliances with little adjustment. The total cost of gas (including capital charges at today's raw materials' prices was in the region of 15d. per therm.

They had noted with great interest that Gaz de France had erected a prototype complete gasification plant, with a capacity of 1.05 mill. cu.ft. per day, at Vierzon and that this plant had supplied the total gas requirements of the region for 12 months. This was a remarkable achievement.

The gas industry in Great Britain provided a two-fuel heat service—gas and coke. In post-war years the national need for fuel economy and coal conservation had focused public attention on the value of this most efficient combination for domestic heating. Accustomed as they were, therefore, to thinking of this dual service, they found it remarkable that in his paper M. Kec referred only to the production and sale of coke for industrial and, particularly, metallurgical purposes. One wondered whether the French producers were interested only in the industrial market for coke.

From the survey given in the paper, it was evident that Gaz de France was making a most valuable contribution towards meeting the fuel needs of France, and to the nation's economic recovery. The rapid progress which had been made in the past six years was an outstanding example of the benefits of co-ordinated effort.

Mr. F. M. Birks, O.B.E. (North Thames Gas Board) commented that Great Britain had followed the French practice to some extent in employing mechanical producers in connection with gasworks carbonising plant. This was not general, however, over the whole country, because in at least one area it was considered that during times of shortage of materials for capital equipment, capital could be better

employed in other directions. Great Britain was fortunate in that it could transport coal cheaply by coastal colliers. Nevertheless great activity was taking place in transmitting gas in increasing quantities over greater and greater distances. In consequence the section of the paper dealing with the high pressure pipelines from Lorraine and the Saar would be sudied in great detail, and they hoped for a full interchange of experience in the future.

Due to the shortage of coal and the high price of imported oil for gas-making, there was interest in what he might term the 'bits and pieces' of alternative materials. Because of this shortage they had seriously to consider anything which might be easily obtained. They must, however, keep a sense of proportion, as in most cases the amounts freely available were small compared to total requirements.

Mr. E. M. Edwards (Wales Gas Board) said that in October, 1950, he had the privilege of visiting various French gas undertakings, including Nangis and Falaise, where propane-air plants were in operation. He would always remember the courtesy and assistance so readily afforded to him by the officers of Gaz de France. The main object of his visit was to study the methods that were being adopted in France to deal with the problem of the maintenance and development of gas supplies on an economic basis to small communities. Subsequently, a butane-air plant was imported from France, and it was now in regular operation at Whitland, together with another plant imported from America. Comparative tests were being made upon both plants, and it was clear that a butane or propane air supply would meet in an admirable manner the needs of consumers.

The development of the process in Great Britain would be dependent largely on the availability of suitable plants at low capital cost, and on butane or propane being supplied on acceptable commercial terms, with an assured security of long-term supplies. The technical problems associated with a new process involving the supply of a gas of 1.22 specific gravity and 730 B.Th.U. had been resolved after study of the experience gained in France and in other countries. If necessary, the plants could be operated without a gasholder and use could be made of a 'surge' tank. The distribution of neat propane also had an application to Great Britain. If the use of butane and propane was to be developed by the gas industry it was desirable that standard codes of practice be prepared to ensure a high standard of safety and efficiency.

The enhanced cost and need for economy in the use of fuel appeared to justify a re-examination of the desirability of installing dry coke quenching plants in this country. The French programme was interesting. At Geneva a semi-continuous plant was used for dry quenching coke from an intermittent vertical chamber-oven plant. At Zurich dry quenching of coke from coke ovens was practised. The engineers in charge of both works spoke highly of the results obtained, and stated maintenance costs were not excessive. The cost of coal, and of coke, in that country was high, and this had influenced decisions to install dry coke quenching plants.

The development of long distance gas transmission systems up to 250 miles, designed for operating pressures of up to 570 lb. per sq. in., for the transmission of manufactured gas, was of major importance.

Mr. H. J. Escreet (North Thames Gas Board) suggested that the problems in France were more complex than in Great Britain, because the concentration of demand in France was much lower and the distances between undertakings considerably greater. The French gas industry had been divided into only eight regions, compared with Great Britain's 12 area boards. The average size of regions in France was 25,000 sq. miles—and the average gas sent out, taking 1946, was 10,000 mill. cu.ft. per region. The area might be compared with the 30,000 sq. miles of the Scottish Gas Board, but the send-out was only about 25% of the sales of that Board in the same year. M. Kec mentioned that trunk mains were tested at 850 lb. per sq. in. and he (the speaker) would like to have details of the method of test and permissible leakage when testing at this pressure.

Mr. L. T. Minchin (London) remarked that in France there was a standard of calorific value for the whole country with the exception of those areas distributing propane-air or pure natural gas. That was a good thing.

PRESIDENTIAL ADDRESS OF J. H. DYDE

(Concluded from page 679)

One plant was encountered for removing nitric oxide by electrical means for the purpose of depressing gum formation.

No case was observed where a solid absorbent was used for benzole recovery, and we found no plant for the removal of organic sulphur, on account, no doubt, of the very low sulphur content of most natural gas.

Our investigations into the extent to which the capacity of existing carburetted water gas sets could be increased and the sets adapted to the cracking of heavier oils were more fruitful.

I do not wish to over-simplify a complex set of operations, but these main conclusions may be of interest:—

(a) Provided the sizes of the generator, carburettor, and super-heater connections, services, and ancillary plant units are adequate and balanced, substantial increase in capacity can be obtained by increasing blast pressure and gasifying oil in the generator as well as the carburettor.

(b) To enable oil to be gasified in the generator, it is essential to provide supplementary air above the fuel bed.

(c) If heavy fuel oils are to be used, it is further essential to employ an empty carburettor, preheat the oil to 250° to 275°F., and use an oil pressure at the sprays of 200 to 250 lb. per sq. in.

(d) It is possible to use oils of Conradson carbon of 6 to 8% without carbon deposition troubles (the steam reaction removing the carbon) and the amount of oil to the generator being not less than 50% of the total.

(e) A useful tip is to use a heavy oil in the generator, and gas oil in the carburettor.

Valuable information was also obtained on plants directly designed for the production of gas from oil. Two processes were examined: the Hall process, as developed by Koppers, and the Poughkeepsie process, as developed by Semet-Solvay. Both are non-catalytic, cyclic, and regenerative, and are being successfully operated, producing gas of 1,000 B.Th.U. per cu.ft. and specific gravity 0.88, to be used in admixture with or as a standby to natural gas.

Gas oil gives the best results, but bunker oils up to 6% carbon are commonly used, while those up to 11% are said to be capable of use.

About 15% of the total oil is consumed as heating fuel. Ordinary carburetted water gas sets can be remodelled, without a great deal of added equipment, to provide gasification units of this type.

The use of liquid petroleum gases was another matter that exercised our attention, and we learned that there are some 400 small communities (of up to 6,000 meters) employing these gases either as neat propane or as propane—air or butane—air mixtures. Their experience in general has been satisfactory. The installations are entirely automatic, and some are working without gasholder storage.

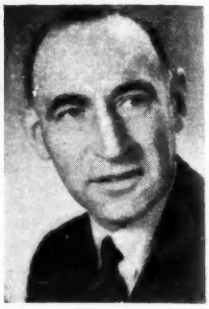
Active research work is going on into complete gasification of coal, but this is directed to the production of synthesis gas by the entrainment method using oxygen under pressure. This synthesis gas is highly advantageous for synthetic ammonia production, and by an additional stage of methanisation would provide gas for the gas industry. It is essential, as natural gas resources become depleted, to have available a gas of high calorific value, and methane appears to be the answer.

Abstract of Comm. No. 435

The South Wales Gas Grid

by

W. R. BRANSON, M.Sc., M.Inst.Gas E. and W. T. HIRD, M.Inst.Gas E.



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THE area with which this paper is concerned includes the counties of Glamorgan and Monmouth and part of Carmarthenshire, and has a total population of approximately 1.5 mill.

South Wales is still essentially a mining and steel-producing area, though, during the past 20 years, light industry has been developed as a result of Government policy. A number of trading estates have been set up, notably at Treforest, Bridgend, and Hirwaun. There is a considerable non-ferrous metals industry, but, with one exception, these works have not made use of town gas on any large scale.

The principal steelworks are integrated plants and include large modern coke oven installations. The quantity of coke oven gas used in these integrated works amounted in 1949 to 8,469 mill. cu. ft., equivalent to nearly 70% of the quantity distributed by gas undertakings in South Wales.

In this area, the Wales Gas Board was faced at May 1, 1949, with problems of gas supply which were probably similar to those of many other area gas boards. Demand for gas was growing rapidly, the total quantity made and bought having increased from 5,868 mill. cu. ft., in 1938, to nearly 12,000 mill. cu. ft. in 1948, the latter figure amounting to 80% of the total for Wales.

Of this 12,000 mill. cu. ft., 6,992 mill. cu. ft., or 58%, was purchased from coke ovens. Coke oven gas was being bought from eight plants, of which four were owned by the National Coal Board.

Gasworks plant was suffering as a result of the difficulties of maintenance and reconstruction during the War years. About 30% of the gas-making plant was more than 30 years old. One of the independent coke oven plants was being maintained in operation only with great difficulty and was to close down as soon as alternative gas supplies could be made available.

The maximum daily output in 1948 was 44.7 mill. cu. ft., the annual output in that year being thus equivalent to 269 maximum days. The industrial load, which in 1948 amounted to approximately 20% of the total, had not, at vesting date, reached proportions where the five-day week was resulting in serious difficulties in balancing production.

Estimates of future demand indicated that, by 1953, some 16,500 mill. cu. ft. would require to be distributed, an increase of about 37% over the 1948 figure, and that maximum daily demand would rise to 63 mill. cu. ft., an increase of about 18 mill. cu. ft. over 1948. Towards meeting this increased load and replacing obsolete plant at gasworks and coke ovens, new gasworks plant of a total capacity of 7.5 mill. cu. ft. per day was under construction or on order, and subject to agreement on the terms of purchase, approximately 9 mill. cu. ft. per day was expected to be available by 1951 from new coke ovens under construction for the National Coal Board at Nantgarw colliery, near Pontypridd. Increasing supplies of coke oven gas were also becoming available from the Steel Company of Wales plant at Margam, Port Talbot, under a contract already concluded by the Port Talbot Corporation.

Provision of the means of distribution of the increasing quantities of coke oven gas becoming available, to points at which it was urgently required to maintain and increase supplies, was the major short-term problem facing the Board. The paper describes the steps that have been taken to provide these means and to co-ordinate supplies of gas from all sources in order to meet, as economically as possible, the present and future gas requirements of South Wales.

The proposed eastern district grid was planned to link 24 undertakings and to draw supplies of purified gas from the Nantgarw coke ovens and from gasworks at Pontypool, Cardiff, and Merthyr Tydfil.

In the western district, it was proposed to supply 16 undertakings from the Port Talbot works, where coke oven gas, purchased from the Steel Company of Wales, would be purified and compressed.

Shortly before vesting date, the Wales Gas Board was informed, by the National Coal Board, of plans for the building of a new coke oven plant at Cwm, within two miles of the Nantgarw plant then under construction. The gas available from this plant was expected to be 5.5 mill. cu. ft. per day initially, when using rich gas firing, and to rise to 8.5 mill. cu. ft. per day when extended about 1958.

This new factor, together with other considerations, confirmed the conclusion that, ultimately, the whole of South Wales should be served by a single grid. This would provide increased security against breakdown, and permit shortages or surpluses in either the eastern or western districts to be balanced as economically as possible. It would also facilitate the planning of a programme of resetting for both gasworks and coke ovens. The inter-linking of the two districts, which will involve the laying of about 20 miles of main through a largely agricultural district, has had to be postponed in view of the heavy mainlaying programme necessary to meet immediate needs. Supply and demand for the period up to about 1956 have, therefore, to be balanced separately in each district.

Eastern District

The installations at Nantgarw and Cwm are planned, when complete, to have available for sale 9.5 and 8.5 mill. cu. ft. per day respectively when fired with rich gas, which could be increased to 17.5 and 16.5 mill. cu. ft. by using producer gas underfiring. (These figures allow for dilution with producer gas to the standard calorific value of 475 B.Th.U.)

The total availability of coke oven gas, including crude gas

(*Continued on p. 693*)

purified at gasworks and not distributed through the grid, is estimated to be as shown in Table 1, where the estimated daily requirements are also given for 1953, 1960 and 1970.

Table 1.—Estimated Requirements and Coke Oven Gas Available (mill. cu. ft. per day at 475 B.Th.U.) in the Eastern District.

Year	Estimated Requirements		Coke Oven Gas Available	
	Maximum Day	Average Summer Load	Producer Gas Firing*	Rich Gas Firing
1953	45·5	30·5	28·0	25·0
1960	51·5	34·5	49·0	34·75
1970	60	40	49·0	34·75

* At Nantgarw and Cwm only.

It was decided in 1949, after a review of the above figures, to proceed with the re-design of the proposed grid so that it might be capable of transmitting the maximum daily output of the two new coke oven plants, and to concentrate gasworks production at Pontypool and Cardiff. The smaller works were to be closed down as grid construction proceeded. Pending installation of producer gas plant, at coke ovens, capable of carrying the whole of the seasonal load, water gas plant was planned to continue in operation at Cardiff, Newport, Dowlais, and Pontypridd, and thereafter to be held in reserve against emergencies. As load increased it was proposed to extend the Pontypool works to double its present capacity, since this undertaking is furthest removed from the coke ovens and local demand is growing rapidly as a result of industrial development and the building of a new town at Cwmbran. At a later stage, the Cardiff works was to be reconstructed as a base-load station.

Western District

Conditions in the western district were similar to those in the eastern district, in that most gasworks plants were old and in need of reconstruction. The maximum daily demand of the 16 undertakings was estimated to rise from about 12 mill. cu. ft. in 1948 to 18.5 mill. cu. ft. at 450 B.Th.U. in 1953, and to 22.5 mill. cu. ft. at 475 B.Th.U. in 1960, by which date standardisation of calorific value throughout South Wales should have been achieved.

Coke oven gas was available at Port Talbot, under a contract between the Steel Company of Wales and the Port Talbot Corporation, up to a maximum of about 6.75 mill. cu. ft. a day, and a further 500,000 cu. ft. was being supplied to the Garw and Ogmore undertaking from the Tondu ovens of the National Coal Board. The latter plant is expected to close down on expiry of the gas supply contract in 1957.

Mains to distribute gas from Port Talbot to a number of undertakings were already laid or in progress of being laid. In view of the urgent need of additional gas at Swansea, where existing plant was in poor condition, it was decided to install two water gas plants at Port Talbot, each of 3 mill. cu. ft. per day capacity, to augment supplies of coke oven gas, and to proceed with the construction of the proposed grid with the exclusion of the section between Swansea and Llanelly, and subject to other minor modifications.

A decision on the extension of the grid westwards from Swansea to Llanelly, Kidwelly, and Carmarthen was deferred pending clarification of the coke oven gas supply position.

The requirements of the remaining 13 undertakings to be supplied from Port Talbot were expected to be met for the succeeding three to four years by the available coke oven gas, the existing installations of continuous vertical retorts at Neath and Port Talbot, and the new water gas plant to be installed at Port Talbot.

Failing increased supplies of coke oven gas, either from the Steel Company of Wales or from the eastern section of the grid, additional coal gas plant will be needed in four to five years time. It is intended that future gasworks production should be concentrated at one or two stations. The water gas plant at Port Talbot forms part of the reconstruction of this works as a purification, storage, and compression station for supplying the grid, and the layout provides space for coal gas plant of 10 mill. cu. ft. a day capacity. Ample ground space also exists at the Morriston works, Swansea, for the construction of coal gas plant of about 15 mill. cu. ft. a day capacity.

While the quantity of 'surplus' gas available from steelworks is normally small, since an internal demand for gaseous fuel exists, it is felt that the use of oil in the steelworks, in order to liberate coke oven gas for town use, is in the national interest so long as a market exists within a reasonable distance.

In view of the shortage of coke, which would follow the reduction of gasworks production, it was decided to investigate the use of coal in water gas plants. Experiments in the use of cobbles of low volatility in hand-clinkered plants at Dowlais were encouraging, and their use has since been extended to self-clinkering plants at other works. Though the economies resulting from reduced loss of fuel and of time during clinkering are confined to manual plants, there have been appreciable financial savings. However, the range of suitable coals is limited.

The final shape of the grid is still not clear. The construction so far completed has been that necessary to distribute gas already available from existing gasworks plant and coke ovens to meet the needs of undertakings. The construction of further sections of the grid will depend in detail upon the location of further sources of supply, which may be from additional gasworks stations, coking plants, or from increased supplies from the steelworks, and may even be from a combination of some or all of these. There is, also, some uncertainty in the location of future demand, since South Wales is still in the process of industrial change and development.

Reference has been made to the proposed interconnection of the eastern and western sections. The length of main required will be approximately 20 miles. Detailed design has been deferred until uncertainties regarding the location of sources of supply in each section have been resolved. It is, however, envisaged that, since flow may be variable and possibly change direction at certain periods, the main will be of relatively small diameter and used at comparatively high pressure, and that provision for re-compression *en route* will be necessary.

Provided that, before this link main and the Caerphilly—Newport main are laid, decisions are reached on the location of the major sources of supply, the economics of the whole system will not be materially affected by any deviation from the assumptions upon which the design has been based, such as would result from a failure to proceed with the construction of the proposed coke ovens at Cwm.

DISCUSSION

Mr. E. M. Edwards (Wales Gas Board) said that the authors had presented an interim account of the development of an integrated gas supply scheme that would eventually serve 42 gas undertakings distributing gas through 67 gasholder stations. In 1948 the total quantity of gas supplied throughout the area was twice that of 1938. In some undertakings the output had increased four and a half times during that period. The area was a special development one, and large increases in industrial demands could not be met unless speedy action was taken. There was a danger of serious failure of supplies in many towns, and the Ministry in 1946 appointed two Working Parties who investigated the position and presented their reports. The schemes put forward by the Working Parties formed the basis of the scheme dealt with by the authors.

Many factors naturally had to receive consideration, and speedy decisions were vital. Regard had to be paid to all existing and planned sources of gas supplies, including gas produced at gasworks, coke ovens, and oil refineries, and the possible availability of methane from mines.

In the planning of a scheme of this nature the assessment of ultimate demand was of critical importance. Thought had to be given to the present and potential availability and prices of alternative fuels; to the local and overall planning and

housing development of the area; to the location of present and future industries and to their fuel needs. Government policy and the dispersal of industry for defence or other reasons, movement of population, changes in the social habits of people, the probable economy and stability of the area were among the features to which special thought must be given. When all this had been done one was able to arrive at a reasoned judgment of future trends, but such assessment could not be absolute and, in this instance, the scheme had been designed with a reasonable measure of flexibility to meet unknown changes in circumstances.

A study of the economic combination of main sizes and pumping pressures showed that the ultimate anticipated pressures were within the safe working limits of spun iron mains. For another scheme, involving a different set of circumstances, steel mains with higher pumping pressures would be used, and experience gained of the effectiveness of cathodic protection.

Decisions in respect of the type of compressors and prime movers used could only be made in the light of facts as they knew them, but thought had to be given to trends of electricity and other fuel costs, to the development of gas turbines, and to improvements in compressor efficiencies.

The availability of coke oven gas was an important factor in the present scheme, but the requirements of the area demanded the formulation of a major integration scheme even if all gas had to be manufactured in large gasworks suitably sited. The extent to which it was desirable for the gas industry to purchase large supplies of gas over which it had limited control was a matter that was receiving particular attention at the present time. Security of supplies and long term availability at the lowest cost were relevant. The national needs demanded that all suitable gas from all sources should be utilised efficiently and economically in the public interest. The operation of coke ovens was largely governed by demand for metallurgical coke, and major reductions in this demand, whether caused by temporary trade circumstances or by improvements in the technique of pig iron and steel production, could have far-reaching consequences.

Determining the Economics

In determining the economics of a bulk supply system one should not ignore the influence of gasholder storage throughout the area. The operation of an integrated system should result in a lower safe ratio of holder capacity to the total maximum daily demand, and the necessity for the construction of additional holders to meet increasing demands could be deferred. The study of gasholder storage costs per therm of gas stored could be revealing, especially in those cases where top lifts of gasholders were seldom uncupped, due to inadequate pressures or other reasons. Security of supply must, of course, be assured. At the same time, care had to be given to plant design and selection to ensure flexibility, and the diversity factor of the various towns supplied by a grid system would result in substantial economies in holder storage costs.

The new carburetted water gas plants at Port Talbot were unusual inasmuch as they were designed for the gasification of coal, or coke, and of gas oil or heavy oil. Also, provision had been made for the reforming of refinery gases. The use of coals of up to 14% volatile content was now the standard practice for the production of carburetted water gas in South Wales.

Compound firing of coke ovens with producer gas or coke oven gas was necessary if undertakings were to avoid excessive production of peak load gas, with attendant high costs, with other normal gasworks plant. This feature required particular attention in those areas with major industrial loads affected by the operation of a five-day working week. The use of dual-fuel engines for the operation of compressors, apart from economics, enabled gas to be used during week-ends and other off-peak periods.

Mr. Edwards concluded his remarks by caustic reference to the high costs of wayleaves on railway property. Here, he said, was a need for a more reasonable basis.

Mr. H. J. Escreet (North Thames Gas Board) commented that, although the grid scheme had originally been drawn up by the Committee set up by the Ministry of Fuel and Power in 1947, the planning staff of the Wales Gas Board had to revise the scheme. To complete this revision in six months, to prepare and organise for the actual mainlaying in a further six months, and then lay 44 miles of main in 18 months by direct labour, with only a nucleus of trained mainlaying gangs, was an excellent performance. The negotiation of the hundred or more wayleaves must alone have been formidable task.

Referring to the design of the eastern grid system, it was noted that the coke oven plants at Nantgarw and Cwm—which supplied more than half the total load—were required to take up all load variations, the gasworks being operated as base load stations. While the reasons for this decision were appreciated, it was unfortunate that the whole of the peak load should have to be transmitted through the grid mains, and the load factor on the grid could have been much improved if the peak load gas could have been made at stations on the east and south of the grid.

In dealing with possible future demand in excess of the estimates, the authors stated that the extra demand might be met either by increasing the capacity of the grid main or constructing additional production units near the source of demand. The latter would appear to be preferable, particularly as the excess load would probably only occur for relatively short periods of the year, and the extra gas might well be made most economically in some type of peak load plant.

The authors stated that additional storage capacity—when required—should be concentrated in large units but that it should be placed near the point of extra consumption. It might well be difficult to reconcile these two aims, but it would probably prove advantageous to erect smaller holders near the ends of the system, so improving the load factor on the grid mains—even though the cost of storage per 1,000 cu.ft. would be higher than would be the case for larger holders less advantageously placed.

Reference had been made in the paper to the proposal of the Working Committee that the grid should be worked at 100% load factor, that no direct supplies to consumers should be permitted, and that all holder stations should be supplied through volumetric governors—presumably at a constant rate throughout the 24 hours. He had never been able to understand this argument, for a steady load could equally well be obtained when supplying direct to consumers *en route*, provided the intake to holders was reduced at times when the direct demand increased, and *vice versa*.

Mr. Escreet said he would like to know why it had been considered necessary to install the valves in pits. Generally he did not think a pit was necessary provided the valve could be operated by an extended spindle and key through a box at ground level. These plug type valves might require grease lubrication, but he believed that this could also be done from ground level. Although Johnson coupling flange adaptors were provided at both ends of the valve it would appear to be difficult to remove the valve through the manholes provided on the pit, and in any case it would be necessary to excavate on both sides of the pit to bag off the main before doing this. If the valve were buried, but little extra excavation would be required to expose and remove the valve when and if this became necessary. If they excavated on both sides of the pit, they might as well excavate the whole valve and save the cost of the pit.

Based on New Plant

Mr. H. D. Greenwood (National Coal Board) remarked that the the South Wales Gas Grid was of special interest in that it was the first time in this country that they had planned a gas grid based largely on new coke oven plants. Previously, schemes have been mainly concerned with coupling-up existing plants. The economics of the new coke ovens and of the gas grid were closely connected—a fact which called for close co-operation between producers and distributors.

In South Wales there were several sources of gas supply: (1) gasworks production, the output of which could be varied within fairly wide limits; (2) gas from certain coke ovens, which must be taken at a more or less uniform rate; (3) gas from other coke ovens, the quantity of which could be varied by practically 100% by using producer gas for heating the ovens; and (4) gas from coke ovens at steel works, the output of which could be varied by using either gas or liquid fuel in the associated steel furnaces. Gas from all these sources had to be fitted into a consumption schedule, in which only 20% of the gas was sold to industrial consumers, and in which the maximum day's output was some 50% in excess of the average summer output and considerably more in excess of the lowest summer output.

The authors gave figures showing that the annual output of a coking plant carbonising 1,000 tons per day, could be 1,620 mill. cu.ft. with 570 mill. used under boilers, and suggested that by operating gas producers the annual output could be increased to 2,970 mill. These figures were misleading. Although it had been the practice in the past to burn coke oven gas under boilers in summer, Mr. Greenwood considered this a misuse of a high grade fuel. He could not envisage a gas undertaking using gas for this purpose, even if it obtained it from its own coke oven plant. The use of coke oven gas as a boiler fuel at a price equivalent to low grade coal must, moreover, seriously upset the economies of a coking plant.

The authors stated that their policy had been to meet the variable demands by making use of the flexibility given to the output of coke ovens by producer gas heating, but a large proportion of the coke oven gas, 90% in 1953 and 70% in 1960 and 1970, was shown to be base load gas, which could only be reduced in output by blowing to waste or by using under boilers.

There were two problems—how to reduce output in summer and how to meet the maximum demand as economically as possible. He had extracted some figures for the eastern grid from the paper to illustrate the summer problem. The paper said that in 1953 the average summer load would be roughly 30 mill. cu.ft. per day whereas 25 mill. was obtained as base load coke oven gas, leaving about 5 mill. provided by gasworks or by using producers at the coke oven plant. In 1960 the average summer load was given as 34.5 mill. cu.ft. per day and the total base load gas as 35 mill. cu.ft., and therefore the gas to be provided by gasworks or by producer gas in 1960 would be 500,000 cu.ft. per day.

He did not know what was meant by 'average summer load,' but he believed that there would be a considerable period in summer when the consumption would be well below 30.5 mill. in 1953. The base load coke oven gas might, therefore, meet the whole of the summer load for periods in 1953 and might well be in excess of the summer load in 1960. This would mean that the whole of the gasworks carbonising plant might have to close down in summer.

The figures in the paper showed that, of the total base load coke oven gas, some 8 mill. was obtained from a coke oven plant integrated with a steel plant, where the steel furnaces were heated with both liquid fuel and gas. They were told by the authors that the supply was contracted at a more or less constant rate, but he would suggest that by replacement of oil by gas in the steel works in summer, a more economic scheme could be obtained which would avoid excess gas in summer and allow a better load factor on the gasworks plant. Unless greater flexibility in the supply of this gas was obtainable it was difficult to see how the supply and demand were going to be balanced to give the most economic return to producers and consumers.

Problem of Maximum Demand

Turning to the problem of the maximum demand, the authors showed that, provided all the ovens at Nantgarw and the proposed National Coal Board plant at Cwm were heated by producer gas, coke oven gas alone would practically meet the maximum demand by 1960. They stated, however, that coke oven owners were reluctant to use producer gas for heating the ovens, owing to the shortage of metallurgical coke. This would suggest to them that was hardly a correct appreciation of the position. Producers were operated with the smaller sizes of coke which were unsuitable for blast furnaces, but so long as there was a general shortage of coke for all purposes, additional supplies for producers might cause temporary difficulties. There had been agreement to install and operate gas producers, provided the extra cost of doing so was fully covered. At present producer gas cost considerably more per therm than coke oven gas.

The winter peak loads could be met by coal gas, water gas, or by producer firing at the coke ovens, or by a combination of all three. The most economic method of meeting the peak loads must be worked out in each locality. From the policy outlined in the paper he gathered that the authors considered that producer gas was cheaper than water gas or than coal gas made with a poor load factor—an interesting conclusion when considered in relation to current prices of coke oven gas.

Mention was made of the probable interconnection of the eastern and western gas grids, and of the greater flexibility which might be obtained in this way. He noted, however, that up to 1956 the two grids were to work independently, and that the consumption and production figures were shown separately up to 1970. It might well be that by connecting together the two grid systems many of the difficulties of which he had spoken might be overcome, and it seemed to him that the earliest opportunity should be taken of providing this connecting link.

Mr. W. H. B. Porter (North Western Gas Board) said that his investigations into distributing costs for supplying Carmarthen and beyond, also into Monmouth, showed that separately they could not stand alone as economic schemes. He used the arbitrary formula of 100% increase over existing demands for determining main sizes where more detailed information was not then available. He saw that the scheme for linking up with Carmarthen was suspended for the time being but the Pontypool to Monmouth link was both projected and authorised. He considered it to be wrong to use the lower weighted average distributing cost for a comprehensive project such as this grid as the only justification for an extension which required material in short supply if, on its own, the extension was not economic.

The introduction of Cwm as a source for coke oven gas in the vicinity of Nantgarw, to the elimination of Merthyr Tydfil as a production station, had obviously necessitated the increase in main size. In the original eastern investigations economics were in favour of recompression at Cardiff and to make maximum use of the existing 12-in. Cardiff-Newport link. He could not read in the paper the case for departing from the Working Party recommendation and for laying mains from Caerphilly to Newport, Pontypool to Newport, and increasing at the same time the Caerphilly to Pontypool (*via* Ystrad Mynach) mains. The Caerphilly-Newport main as authorised and to be laid would not be needed for some years, and its size might be varied.

Mr. Porter asked whether the authors had been able to assess the savings to be effected by introducing remote control. There was unquestionably an improvement in efficiency with remote control over the automatic arrangement. Presumably they would recommend more than one control room for the wide area to be served if recording, alarm, or remote operation of low pressure station governors was included at control.

Governors in the Open

The costly positive displacement meter for bulk supply schemes was no longer necessary. They had sufficient experience with inferential meters to know that they could be accurate if correctly sized and located. This led to the other important point in consequence of high building costs—namely, that from experience elsewhere they could, without impairing efficiency of control, situate volumetric and station governors, together with valving arrangements, in the open, provided that neither children nor the public had access to the equipment. With proper maintenance this type of equipment would work satisfactorily through extremes of cold and heat far beyond those experienced in this country.

The pipeline constructional work had been carried out exceptionally well in some of the most difficult terrain to be negotiated in this country. As far as mains costs were concerned, would the authors state the respective percentages of on costs used for direct labour and work out to contract?

The freely negotiated assessments with private landowners were reasonable and fair, and they clearly indicated that those of the Railway Executive were abnormally high.

Mr. Branson, in a brief reply to the discussion, remarked that Mr. Greenwood had asked for a definition of 'average summer load.' The average summer load referred to in the paper was the average daily load of the summer period excluding August Bank Holiday, the Whitsun Holiday and similar holiday periods. As he surmised, there would be short periods when the demand was appreciably below that.

In regard to the cost of producer fuel for the underfiring of ovens, the remark in the paper as to the reluctance of coke oven owners to employ producer gas for underfiring was perhaps misinterpreted. The object of the reference was to point a way, which might be exploration, to reduce the cost of producer-gas firing by the utilisation of coal rather than hard coke.

Mr. Porter had referred to the inclusion of Monmouth in the scheme. He assured him that the case was worked out not on average weight of cost but on inclusion as a separate project; and in view of the extensions to the Monmouth works which would otherwise have been necessary, the capital cost of both main and new plant being taken into consideration, it was cheaper to supply in bulk from the grid.

Abstract of Comm. No. 40

Progress in Gas Purification

by

H. HOLLINGS, O.B.E., D.Sc., M.Inst.Gas E., F.R.I.C.

THE need for some improvement in the process and plant based upon bog ore is urgent because of the difficulty of recruiting labour in certain works. When the conventional rectangular boxes are used, the labour requirement for emptying and filling is high and the work of emptying is arduous and unpleasant. The provision of trays which act as containers for the oxide, and which can be lifted by crane, is an appreciable improvement, and this feature is already used in tray purifiers and tower purifiers. In tray purifiers and tower purifiers it has hitherto been the custom to stand the tray of spent oxide on the ground so that men can break the mass and empty the tray by hand. It has now been proposed in tower box purifiers that the tray of oxide shall be clamped in a frame and rotated through 180° by a mechanical tipper, any severely caked oxide being first loosened by pneumatic tools. It is anticipated that the oxide will then fall into a hopper and be fed directly to a crusher. Each tray will contain only one layer of oxide, and the grids will be kept in place during tipping.

An order has been placed by the North Thames Gas Board for tower box purifiers for a stream of 7.5 mill. cu.ft. of coal gas a day. The installation consists of six rectangular towers built in line with common walls. Normally, five towers are at work while the remaining tower is being emptied and re-filled, but the gas connections permit the use of all six towers at times of peak load. A stocking frame is also provided for trays ready filled with new oxide. The advantages of being able to load trays with prepared oxide on the ground and storing them ready for use in the stocking frame, and of lifting the trays of spent oxide from a tower and emptying them by tipping, should do much to improve working conditions in purifiers. It is appreciated that the system of emptying by tipping has not yet been put into practice, but sufficient confidence is felt in the scheme to order also a tower box installation for a stream of 4 mill. cu.ft. per day, and a tower purifier installation equipped with mechanical tipping for 7.5 mill. cu.ft. a day.

Use of Copperas

Many of the early attempts in industry to prepare a purifier mass of artificial bog ore were based upon reactions between iron compounds and ammoniacal gas liquor. The recovery of ammonium sulphate without the consumption of sulphuric acid has attracted the attention of many inventors, and waste pickle liquor has often been the starting-point. Of the two main problems associated with such processes, the first—namely, the expensive evaporation of very dilute solutions of ammonium sulphate—has now to a great extent been solved, partly by use of concentrated ammoniacal liquor and more particularly by the availability of large quantities of solid copperas. A satisfactory solution of the second problem, the purity of the by-product ammonium sulphate, has not hitherto been available.

It is well known that when ferrous carbonate is precipitated from the solution of a ferrous salt by ammonium carbonate, the reaction is not complete, and appreciable quantities of iron remain in solution, even when an excess of reagent is employed This iron is slowly precipitated by oxidation over a period of several days if the solution is allowed to stand. When concentrated ammoniacal liquor is used as the reagent, the same effect is observed, and it is clear that unless this incomplete precipitation is overcome it is impossible to obtain ammonium sulphate which is not contaminated with iron. To accomplish this, the use of oxidising agents to accelerate the precipitation, and of hydrogen sulphide to precipitate the iron remaining in solution, have both been suggested, but neither method commends itself for application on a large scale.

When the reaction between copperas and concentrated ammoniacal liquor was studied in the Fulham laboratory it was noted that the sulphide in the liquor was completely precipitated, the solubility of ferrous sulphide being lower than that of the hydroxide and carbonate. This observation suggested that if properly applied, ammoniacal liquor itself could be used to give complete precipitation. This implies an excess of sulphide ions in solution when the reaction is complete, and it is clear that the removal of the bulk of the ferrous carbonate is essential before the final precipitation, since this will dissolve and react with sulphide in alkaline solution. Experiments on the two-stage precipitation were carried out, and these showed that iron-free solutions of ammonium sulphate can be obtained by the use of a 15% excess of concentrated liquor in the second stage. In addition, it was found that where the copperas is available as fine crystals, the reaction may be carried out using the solid in place of copperas solution, so that a still stronger solution of ammonium sulphate may be obtained. (See F. A. Burden and C. H. Robinson, B.P. App. 16256/51.)

It should be kept in mind that the precipitated ferrous carbonate and sulphide are readily oxidised and converted into what R. H. Griffith and A. R. Morcom (*J.C.S.*, 1945, 786) have shown to be the two forms of iron oxide most reactive with hydrogen sulphide—namely, α and γ $Fe_2O_3.H_2O$.

The Basis of the Process

These observations form the basis of the proposed process to be carried out. Copperas, bought in the form of fine crystals, but which may have caked in storage, is passed through a breaker to reduce aggregates to a size not exceeding ½ in., and is fed from a measuring table to a stirred tank in which it is mixed with sufficient filtrate from the first-stage filter to form a thick slurry. The mixture is pumped to the first-stage reactor, where it is mixed with the required quantity of concentrated ammoniacal liquor. The mixture is heated to 70°C. by passing in steam and ammoniacal vapours produced in the evaporation of the final ammonium sulphate solution, so that the quantity of fresh concentrated liquor required is from 85% to 90% of the theoretical amount. The slurry from the reactor, containing about 17% of suspended solids, passes to the first-stage filter. This is a rotary vacuum filter, with facilities for washing the solid cake, and may be of mild-steel construction, rubber-lined, and with stainless steel perforated plates and fittings. The solid cake produced will contain 45% to 50% of water. The filtrate is pumped without further heating to a pipe in which about 15% of additional concentrated liquor is mixed with it, and thence to a buffer tank and the second-stage filter. This is a Sweetland-type leaf filter, intermittent in action, and requires buffer tanks for feed and filtrate to permit continuous operation of the remainder of the plant. The feed to this filter will contain 2% to 4% of suspended solids. The

filtrate, now free from iron, is evaporated for recovery of the ammonium sulphate. The ammoniacal vapours stripped from the filtrate are employed in the first reactor, as stated above. The solid is discharged from the second-stage filter by sluicing off with filtrate from the first-stage filter, and the sluicings are returned to the inlet of the rotary filter, from which all the solids are finally discharged. The solid is fed directly to a trough mixer where it is incorporated with burnt oxide and finally divided peat from separate measuring feeders. If preferred, the burnt oxide may be omitted.

The product is spread evenly on a concrete floor to a depth of 6 in. for 24 hours.

Assuming that the plant will work 24 hours per day for 300 days per annum, there will be required:—

Copperas ...	30 cwt. per hour	10,000 tons per annum
Peat (50% water)	10 cwt. per hour	3,330 „ „ „
Burnt Oxide ...	5 cwt. per hour	1,670 „ „ „
Concentrated liquor 230 gal. per hour		1,670,000 gal. „ „
Containing approximately		17% NH_3 } 17% CO_2 } w/v 5% H_2S
Power	90 kW.	
Steam	5,250 lb. per hour.	
Water	10,000 gal. per hour.	
Labour	Three men per shift and three day men.	
Area for oxidation ground (two days make)		10,000 sq. ft.
There will be produced:—		
Artificial purifying material (40% H_2O)		11,000 tons per annum.
Ammonium sulphate		4,300 tons „ „

Solvent Extraction of Spent Oxide

If the gas industry is to change over to the use of more active forms of iron oxide, it may prove to be the case that they will only be obtained in a suitable physical as well as chemical condition at a somewhat higher price, and accordingly care must be taken not to destroy the chemical activity of the material by burning the spent oxide in a sulphuric acid plant if other means can be devised for separating the sulphur and regenerating the iron oxide in a form still suitable for gas purification. Furthermore, pure sulphur is a much more readily marketable commodity than spent oxide, as has been reiterated in many quarters during the last few years. Accordingly, much attention has been given to the extraction of sulphur from spent oxide by means of solvents. The chief concern is with tarry spent oxide, which is obtained in the absence of efficient plant for tar removal from gas.

The only solvent which has been used commercially in this country hitherto is carbon bisulphide. It is the general experience, confirmed by our own laboratory experiments as well as by those of the Gas Research Board, that, when starting with a spent oxide containing tar, the resultant sulphur is not sufficiently pure for the manufacture of contact sulphuric acid. Furthermore, it has not been found possible to modify the extraction process when using carbon bisulphide so as to obtain a better separation of sulphur from tar. It is known that on the Continent the carbon bisulphide solution has been subjected to treatment with oleum, but this process has not been adopted in this country.

In the Fulham laboratory, a general survey of other solvents for sulphur was made about 1945. At the 17th autumn research meeting of the Institution F. A. Burden and W. B. S. Newling described* their work in connection with the use of toluene and, particularly, in connection with the control of the crystallisation process (F. A. Burden and G. U. Hopton, B.P. App. 27713/50) necessary to give sulphur of high purity, leaving the tar in the mother liquor.

The pilot plant is now working. The molten sulphur run off from the crystalliser vessel is found to have a purity of 99.83%, when starting with 50% sulphur and 1.4% tar in the spent oxide. It has been found desirable to modify the design of the agitator, and this may result in still purer sulphur.

Liquid Purification

In 1942, the Koppers Company installed a new process at Pittsburg. As in some earlier processes of this Company, the gas was washed with a solution of sodium carbonate, but the sulphided solution was reactified by heating under reduced pressure instead of by oxidation. In 1948, a second plant was installed by the Koppers Company at the Seaboard coking plant in New Jersey. The operation of these plants has been investigated very thoroughly in conjunction with the Woodall-Duckham Company. It appears that this process is free from the disadvantages of certain other processes, and the North Thames Gas Board has decided to install a plant having a capacity of 13 mill. cu.ft. of gas per day at Beckton.

This W.-D. Koppers vacuum carbonate system, which is an absorption and desorption process employing a solution of sodium carbonate as the washing medium, will be designed to

* Burden, F. A., and Newling, W. B. S. 'Recovery of Pure Sulphur from Spent Oxide.' *Inst. Gas Eng. Comm. No.* 397.

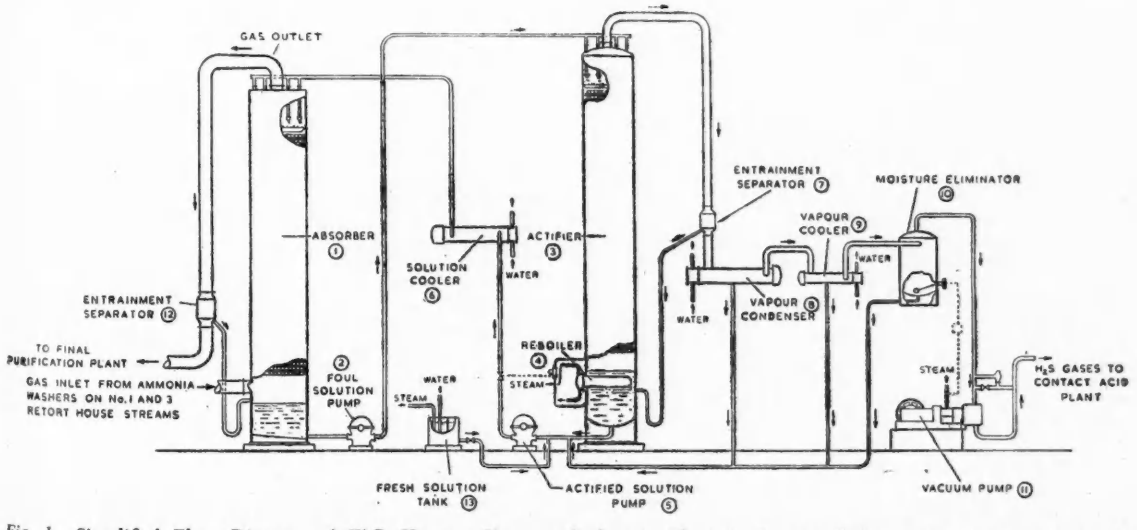

Fig. 1.—Simplified Flow Diagram of W.D.-Koppers Vacuum Carbonate Plant to be Installed for the North Thames Gas Board on Nos. 1 and 3 Retort House Gas Streams at Beckton.

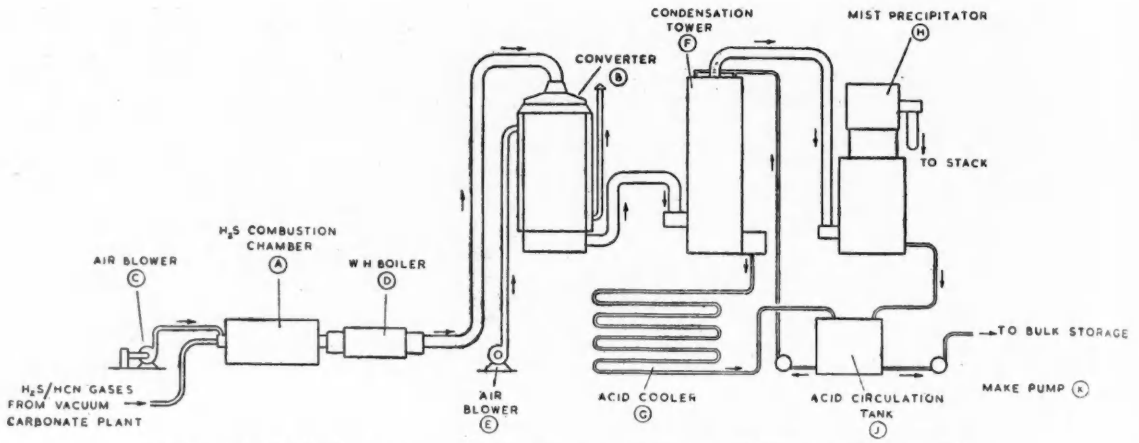

Fig. 2.—Simplified Flow Diagram of the Huntington-Heberlein Sulphuric Acid Contact Plant.

reduce the H_2S content of the gas from 480 to 48 gr. per 100 cu.ft., and the HCN content from 60 to 9 gr. per 100 cu.ft., the removal efficiency being 90% and 85% respectively.

Fig. 1 is a simplified flow diagram of the process.

It will be seen that the gas leaving the ammonia washers, which will contain less than 1.5 gr. of ammonia and not more than 2 gr. of naphthalene per 100 cu.ft., will be delivered to the base of the absorber (1), where it will be washed counter-currently with sodium carbonate solution at approximately 75°F., the normal temperature of the gas at this point in the gas stream. The absorber will be a wood packed tower. The gas leaving the absorber and the entrainment separator (12) will still contain about 10% of the hydrogen sulphide in the crude gas. It is the intention that during all the preliminary trials of the liquid purification process the residual hydrogen sulphide will be removed in existing boxes. These boxes are, however, nearing the end of their working life, and it will be necessary within a few years to make a decision upon the form of plant for the final purification in the light of all the developments now in progress.

The foul solution, containing the hydrogen sulphide, hydrocyanic acid, and some carbon dioxide absorbed from the gas will collect at the bottom of the absorber and will then be transferred by the foul solution pump (2) to the sprays at the top of the actifier (3), which will also be a wood packed tower.

Counter Current Stripping

During passage down the actifier, the hydrogen sulphide, hydrocyanic acid, and carbon dioxide will be substantially removed from the foul solution by counter-current stripping with water vapour under vacuum. The actifier will be maintained under a relatively high vacuum to reduce the quantity of heat needed for actifying the solution. The volume of stripping vapour required remains about the same under vacuum as at atmospheric pressure, but the weight of vapour and the heat required to generate it are greatly reduced when operating under reduced pressure.

The stripping water vapour will be provided by boiling the solution collecting at the base of the actifier by means of a tube nest re-boiler (4), employing low-pressure steam mainly supplied from the steam-driven vacuum and solution pumps on the plant and from the works exhausters. It should be noted that the source of heat supplied to the actifier has an important influence on the economics of the process, and, where local conditions permit, it is generally desirable to supply this heat by means of heat exchange.

The actified solution will be withdrawn from the base of the actifier by the pump (5) and, after passing through the solution cooler (6), will be returned to the sprays at the top of the absorber to complete the cycle.

The stripping vapour leaving the top of the actifier together with the liberated hydrogen sulphide, hydrocyanic acid and some carbon dioxide will pass successively through an entrainment separator (7), vapour condenser (8) and vapour cooler (9) which will remove the bulk of the water vapour and cool the permanent gases. The condensate will be returned either to the base of the actifier or to the solution circulating system.

On leaving the vapour cooler, the hydrogen sulphide gases will pass through a moisture eliminator (10) designed to prevent appreciable quantities of liquid passing forward beyond this point, and then to the steam-driven reciprocating, dry vacuum pumps (11), which will maintain the requisite vacuum throughout the actifier system. The hydrogen sulphide gases will be delivered by the vacuum pumps direct to the contact acid plant.

It will be seen that no oxidation of the liquor is attempted in the process, and in consequence the objectionable side reactions encountered in many liquid purification processes, and the associated effluent disposal problems which arise, will be reduced to a minimum.

It is anticipated that the gases recovered from the actifier will contain about 70% of hydrogen sulphide, 10% of hydrocyanic acid, and 15% of carbon dioxide. It is the practice in America to wash out the hydrocyanic acid and to recover it as sodium cyanide or liquid hydrocyanic acid. The hydrogen sulphide is then burnt in an acid plant of the dry contact type.

At the Beckton products works there is now considerable experience of burning hydrogen sulphide in a wet contact acid plant, and, after investigations in conjunction with Huntington, Heberlein and Co., Ltd., and the Lurgi organisation in Germany, it has been decided to adopt this process on the gasworks without any prior wash for removal of hydrocyanic acid.

A Safeguard

As a safeguard against the possibility that the high concentration of hydrocyanic acid will interfere with the efficiency of the sulphuric acid manufacture, provision will be made to insert a process for the hydrolysis of hydrocyanic acid which has been developed in the Fulham laboratory by W. B. S. Newling and J. D. F. Marsh (B.P. App. 7130/51) and proved successful on a large pilot-plant scale by the Koppers Company in America. It is hoped, however, on the basis of the latest information available, that this addition to the plant now being described will not be necessary, but that the hydrocyanic acid will be completely oxidised in the combustion chamber marked (A) in Fig. 2, which illustrates the Huntington-Heberlein sulphuric acid plant.

The mixed hydrogen sulphide—hydrocyanic acid gases will be delivered by the vacuum pumps to the burner of the combustion furnace (A), which will be supplied with filtered air by the blower (C) in sufficient quantities for the combustion of the gases in the furnace and the subsequent oxidation of the sulphur dioxide to sulphuric anhydride in the converter (B).

The products of combustion leaving the horizontal brick-lined combustion chamber, will pass through a waste-heat boiler (D), where they will be cooled to the correct temperature of about 450°C. before entering the converter. The steam raised in the boiler at a pressure of 220 lb. per sq. in. will amount to approximately 1,800 lb. per ton of acid produced, calculated as 100% sulphuric acid, and will be used on the contact acid and vacuum carbonate plants.

The converter will be a multi-stage, tray-type unit in which the gases pass through a number of layers of vanadium catalyst. The heat of reaction in the converter will be removed by a cooling jacket through which air will be circulated by the blower (E). The catalyst is not affected by the presence of water vapour.

The gases leaving the converter at a temperature slightly above 400°C. will be cooled and condensed in a tower (F), the construction being similar in principle to the well-known Glover tower, although of relatively small dimensions. Sulphuric acid of suitable concentration will be circulated over the tower and cooled externally in special acid coolers (G).

Owing to the presence of moisture, the production of acid in the tower will be mainly by condensation and only slightly by absorption, and in consequence the remaining acid will be carried forward in the form of mist to the electrostatic precipitator (H), where it will be removed and drained to the circulating tank (J), from which the make will be transferred by the pump (K) to bulk storage.

It is anticipated that the plant will produce about 12½ tons of 140°Tw. acid per day.

The novel features of the new plant compared with the pre-war design installed at the Beckton products works will be the use of the condensation tower and electrostatic mist precipitator in place of the condenser on the old plant, and the introduction of a waste-heat boiler for cooling the combustion gases.

The Claus Kiln

In any future liquid purification scheme, it may not be desired to produce sulphuric acid on the gasworks, and accordingly much thought is being given to the possibility of adopting the Claus kiln as an alternative. This may prove to be a more suitable plant and process for the smaller works. The storage and disposal of sulphur may be easier than of acid. In an attempt to improve the efficiency, the reactions of the kiln are now the subject of laboratory investigation, but it is too early to report any results.

DISCUSSION

Mr. W. K. Hutchison (Chairman, South Eastern Gas Board) paid a personal tribute to Dr. Hollings, whose impending retirement from the position he has held in the industry with distinction for many years was universally regretted. He wished Dr. Hollings great happiness and good health on relinquishing his duties with the North Thames Gas Board and the Gas Council.

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W. Kirk (Motherwell), R. Sturrock (Ardrossan), and W. A. M. Stewart (Armadale).

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F. Harvey (Grimsby), E. B. Field (Sheffield), and J. S. Marshall (Lincoln).

Mr. T. C. Finlayson (Chairman, Woodall-Duckham) suggested that the attractiveness of the vacuum carbonate process might be attributed to the following features: Firstly, it did not attempt to remove 100% of the hydrogen sulphide from the gas, which simplified the process both from chemical and chemical engineering points of view. Secondly, as Dr. Hollings pointed out, it did not attempt to oxidise the hydrogen sulphide, which step had been the downfall of so many processes by reason of noxious thiosulphates and thiocyanates, corrosion problems, contaminated sulphur, and so on. The vacuum carbonate process was a simple absorption and desorption process carried out in such a way as to keep chemical interaction between washing liquid and gas to the absolute minimum. The oxidation of the H_2S was performed in a separate stage by the combustion of the H_2S gas in an acid plant or a Claus kiln. Thirdly, the equipment comprised a number of units of well-established design.

Limitations of the Process

The limitations of the process were, firstly, that some form of solid oxide treatment plant was necessary to remove the last 10% of H_2S. Secondly, that the economics of the process placed a lower limit of, say, 10 mill. cu.ft. of gas per day on each installation. Thirdly, that it was necessary to provide either an H_2SO_4 plant or sulphur recovery plant to oxidise the recovered H_2S.

It was a matter of great satisfaction that the North Thames Gas Board had decided to install the first of the vacuum carbonate plants to be built in this country, the results of which would be watched with the greatest interest by a wide technical audience.

It might be of interest to record that within a few months of the completion of work on the hydrolysis of HCN in the Fulham laboratory a pilot plant to test the process was designed and put to work in America by their associates where the suitable H_2S concentrate was available. The laboratory results were almost quantitatively confirmed on pilot plant scale.

Mr. H. B. Avery commented that, in discussing the question of solvent extraction, it was stated that it had not been found possible to modify the carbon bi-sulphide extraction process to obtain a better separation of sulphur from tar. In fact, the extraction plant using carbon bi-sulphide was worked from 1930 to about 1934 in such a manner as to obtain fractionation of the tar and sulphur to a very marked extent.

Prior to that period they had been aware that in the tarry sulphur recovered from carbon bi-sulphide solution tar was not distributed evenly through the sulphur but existed as a film on the surface of the crystals from which it could be removed by washing with a tar solvent such as benzole or toluene, yielding a sulphur of much increased purity.

Further, a siturated solution of sulphur in carbon bi-sulphide could also be used for this purpose. In the plant they used this latter method, obtaining a saturated solution of sulphur *in situ* from the spent oxide being extracted. This method enabled

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J. B. McKean (South Eastern Gas Board) with J. H. H. Magson (Dover).

them to obtain a concentrated tarry fraction in which approximately 20% of the total sulphur contained 80% of the total tar, leaving the remainder of the extracted sulphur containing 80% of the sulphur with approximately 20% of the tar. The two fractions contained up to 14% of tar in the tarry material and less than 1% in the clean fraction.

At this period the average tar content of the directly extracted spent oxide was 3½% and the improvement enabled them to use or sell the low tar content sulphur which they found could be used for the manufacture of sulphuric acid, in chamber acid plants, carbon bi-sulphide, or liquid SO_2

Application for a patent covering this method of working failed owing to the production by the German Patent Office examiners of a prior patent by McDougall, of Manchester, before 1900, in which the subject-matter was disclosed although no evidence of the practical application of the process could be found. In this Patent McDougall specifically mentioned the use of a saturated solution of sulphur in carbon bi-sulphide for the removal of tar from tarry sulphur.

The fractionation process was continued in a modified form until rendered unnecessary by the steadily improving quality of spent oxide, enabling them to obtain by selective purchase spent oxide which yielded approximately 1% of tar content in the extracted sulphur. This quality of spent oxide was now increasingly available owing to the improvement in gasworks technique and to the increasing availability of coke oven spent oxides which were substantially free from tar.

This emphasised the importance of effecting the maximum reduction of tar fog in the gas entering the purifiers, and showed that such reduction could be made. The extracted sulphur at present recovered was considered to be sufficiently pure for the manufacture of contact sulphuric acid and was intended for use in such a plant which they were at present erecting.

Juggling with the Answers

Mr. J. E. Davis (South Eastern Gas Board) remarked that to those who desired a simple answer to a simple question the possible alternative solutions presented in the paper might seem an irritation, but it was important to understand that life was like that and it was often necessary to juggle with half-a-dozen possible answers until the passage of time clarified a situation and it was seen which of the half-dozen would fit the current circumstances best. It could be that sulphur extraction from spent oxide, liquid purification, and pelleted oxide might come into their own through the high price of peat.

Mr. J. Foxton (South Western Gas Board) remarked that Dr. Hollings has stated that the conventional types of purifying materials would be used for many years to come, and it was an inescapable fact that many existing oxide boxes would have to function for a much longer period than the more progressive engineers and chemists desired. The possible improvement in oxide reactivity, together with higher velocities, would play an important part in prolonging this period. The economic situation in the industry compelled them to use plant which was outdated, but nevertheless must continue to render efficient service.

Assuming that the advances promised in purifying materials were realised, the greatest objection to old-type boxes was that labour, and handling the oxide, presented difficulties which became greater with increased frequency of changes.

The Side Approach

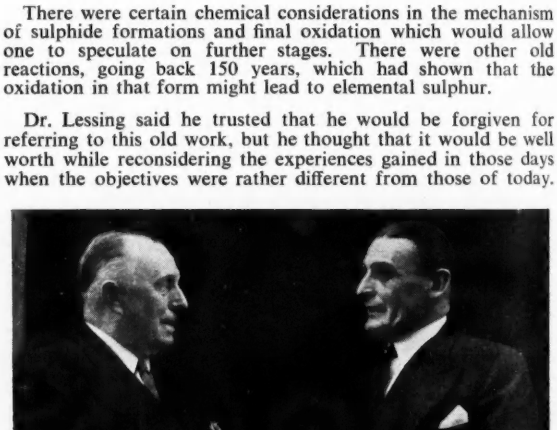
Without cranes and grabs, the most laborious way to move stacked material was from the top. Much less effort was required by a side approach from ground level. The introduction of mechanical shovels had speeded up the task and reduced labour costs. Why should this approach not be made when oxide boxes had to be emptied?

Dr. R. Lessing (London) said that in the early part of this century copperas was used for direct gas washing, and not for the purpose of sulphur removal. Work on a relatively large scale was carried out at Silvertown and at Bromley. At that time there was no research department. All the work had to be done by the single-handed working research chemist on the plant. One simple advantage which he thought might be gained by recalling old experiences was that the problem of hydrogen cyanide, which loomed large and for which a special process had to be devised, might be solved in a relatively easy manner. The copperas could be charged as a solution in the gas outlet bay of a multi-stage washer. Here it would form ferrous sulphide which after separation from the ammonium sulphate solution would be used in the gas inlet bay for cyanide extraction.

That would give the advantage that in the middle stages, whatever process for the extraction of ammonia was used, the copperas at the outlet end would allow them to get a much more concentrated solution, and it would form a check to avoid any slip of ammonia through the system.

There were certain chemical considerations in the mechanism of sulphide formations and final oxidation which would allow one to speculate on further stages. There were other old reactions, going back 150 years, which had shown that the oxidation in that form might lead to elemental sulphur.

Dr. Lessing said he trusted that he would be forgiven for referring to this old work, but he thought that it would be well worth while reconsidering the experiences gained in those days when the objectives were rather different from those of today.



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H. V. Corfield (Brighton) and K. Carey (Willey & Co., Ltd.).

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Abstract of Comm. No. 406

Oxide Purification in Towers

by

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IN 1945, the increasing demands for gas made it necessary to consider the provision of additional carbonising plant at the Nechells Works of the Birmingham District. The coal gas purifiers were at that time in a poor condition, and, as the additional carbonising plant would necessitate an extension to the purifiers, it was decided to include plans for completely new purification plant with the required increase in capacity. The provision of additional railway sidings had also to be made for the handling of the heavier coal and coke traffic. The only space available was that then occupied by 24 box purifiers with six overhead catch boxes, and a small vacant space adjacent.

It was decided to install tower purifiers in two sections, each having a capacity of 12 mill. cu.ft. per day. The first section would fully occupy the vacant space available and, when in commission, would release half of the old purifiers, which could then be demolished and provide room for the second section of towers. The experience obtained by the then Wandsworth Gas Company in the performance of towers was so satisfactory as to indicate that, in these circumstances, our decision was sound.

A contract was placed in November, 1945, for an installation consisting of 12 working towers (22 ft. 3 in. dia. and 61 ft. high, to purify 24 mill. cu.ft. per day) arranged in two sections, each of six working towers with a stocking tower and stocking frame. These were all welded and were the first to be so constructed.

There are 14 containers in each tower, and 14 spares which are held in either the stocking tower or stocking frame. Each container has two trays, the depth of purifying material in each being 17 in. The gas enters through ports in the centre cylinder and travels upwards through the upper and downwards through the lower layers to the periphery of the tower shell and thence through the outlet connection.

The whole installation is served by a 60-ton 'Goliath' crane with a span of 70 ft.

The air for revivification is supplied by two of three Connersville blowers, each of 30,000 cu.ft. per hour capacity, driven by variable-speed motors, one blower working to each set of six towers. The air can be introduced at the inlets of individual towers, and is measured by a Kent orifice meter. Similarly, the gas flow through each section is also recorded.

Steam connections are made to the inlet of each tower so that raising of temperature and humidification may be selective.

In Birmingham, it had been the established practice for many years with box purifiers to foul the purifying material, which was an active artificial oxide, in one exposure; the changing of boxes took place every 8 to 12 months, the spent material then containing from 46% to 48% of sulphur. When towers were considered, therefore, it was assumed that it would be possible to adopt the same procedure, and no provision was made for crushing or disintegrating the oxide. When it was deemed necessary to adopt the 'two-exposure' method, the installation was modified to include a hopper built on to the existing unloading gantry. A roll crusher situated at the mouth of the hopper feeds on to a belt, which conveys on to a disintegrator. The disintegrated material is fed to one of two grabbing pits, whence it is returned, after mixing, direct into the emptied containers by a mobile grabbing crane.

The moisture content of the material returned to the container is usually between 23% and 25%.

Early Experiences

In January, 1949, the first four towers were put into commission, followed within a fortnight by the two remaining towers, thus completing the first section. It is important to note that they were all charged with new oxide as previously used in box purifiers. It was not then possible to meter the volume of gas passing the towers, as the inlet and outlet mains were also serving the old sets of boxes, but the quantity was calculated on the basis of the nitrogen content in the purified gas and the measured air for purification.

The summer of 1949 was trouble-free; the average load factor was 66%, and changing of sequence was necessary only once in three or four days. One particularly noticeable feature at this stage was that the temperatures remained unusually high throughout the series, and that there was no cooling up to the last tower in the sequence.

As the winter of 1949-50 approached, the load factor was increased to 92% and we were in serious difficulties, as it was impossible to hold the same sequence of tower workings for more than a few hours. Only slight cleaning up of the last tower resulted from a change round, and on several days we were changing three times in 24 hours, and had on occasions to work a night purifier staff. The air for revivification was increased to as much as 7%, in the hope that more rapid rejuvenation of the oxide in the last towers would result.

On January 3, 1950, the first tower was changed and re-filled. Examination of the removed oxide revealed patches of poorly fouled oxide in the upper layers, and it was observed that there was a definite tendency for the bottom inch or so of the upper layers of oxide to harden and form an impervious layer. The effect of this would be to restrict the flow of gas through the upper layer and cause overloading of the lower layers. It was thought that the local hardening might be due to excessively rapid reaction, and to minimise this it was decided that newly charged towers should not be placed as first taker for more than a few hours for several weeks after putting to work, and, in addition, that neither steam nor air should be admitted direct to the tower during this induction period. As a further precaution, a ½ in. thick layer of wood wool was placed on the top grids of each container as it was changed. Later observations showed that this became compressed and was not effective.

Careful examination was made for radial fissures and for any clearance spaces between the oxide and the container sides and centre tube, but it did not disclose any obvious conditions conducive to short-circuiting. It should be stated also that very little real evidence of slip in this manner had been shown. No fissure of any depth was seen, and the spent oxide when discharged was nearly always found to be firmly bound to the ironwork at all points.

The spent oxide was dry and dusty, but the moisture content was very variable and in some parts of the layers was higher than that normally present in spent oxide out of box purifiers. It should be noted, however, that the significance of the heterogeneous distribution of the moisture was not fully appreciated at the time, and was only disclosed in our later work. It was realised that some form of moistening was desirable, and at the second time of re-charging of the towers a spray was fitted to give an atomised water discharge at the base of each rising inlet main. These finely atomised water sprays were in continuous operation for many months, but no improvement was apparent. In two of the towers, the sprays were subsequently arranged in a tier of five on a rising pipe from the bottom to the top of the inlet rising main, but again proved ineffective because of irregular distribution of the water. This was evident when the containers were examined, as parts of the oxide were quite sodden and inactive.

Comparison with Towers at Wandsworth

In March, 1950, a visit was made to Wandsworth to compare our respective experiences, and every assistance was given to enable us to obtain full information. It was hoped that this comparison would give some enlightenment on the reasons for the apparent failure at Birmingham. There were, however, two main fundamental differences in our respective conditions—namely, the hydrogen sulphide content of the inlet gas and the weight of oxide in the towers, as shown:—

	Nechells	*Wandsworth*
H_2S (gr. per 100 cu.ft.)	500 to 950	350 to 600
Weight of oxide per tower (tons)	210	300

The latter variation is accounted for by the difference between the bulk densities of two types of purifying material.

There was also a difference of approximately 15° to 17°F. in the temperatures of the towers, those at Wandsworth being 68° to 85°F., while those at Nechells were 85° to 100°F. This difference was attributed to the higher hydrogen sulphide content and the heat of reaction.

There was no difficulty at Wandsworth in selective fouling by working the oldest tower in first position for a period of up to seven days, while still maintaining two clean outlet towers; whereas at Nechells the conditions became so bad that it was not possible to hold the same sequence for more than a few hours, as previously mentioned, although the throughput of gas had been as low as 6 to 7 mill. cu.ft. per day for several months, with air admission amounting to approximately 6%.

In September, 1950, further discussions with the contractors ensued, when we suggested that the relatively shallow layers of oxide, as compared with box purifiers (1 ft. 5 in. to 3 ft.) might result in insufficient diffusion and that selective fouling might be occurring in localised streams.

This effect might be aggravated by the very light resistance, as shown by the back pressure, averaging ¼ in. W.G. per tower. It was therefore decided:

(1) To obtain purifying material of higher bulk density, and

(2) to examine the possibility of altering the containers to accommodate one 3 ft. deep layer of oxide.

It was also decided that a thorough system of investigation into the operation of the towers was required in relation to the chemical and physical aspects of the process.

Results of Investigation

There appeared to be two main reasons for the observed behaviour of the towers, as follows:—

(1) The formation of a thin, but hard and comparatively impermeable layer of spent oxide in contact with the grids at the base of the upper layers of oxide. This impermeable layer caused a permanent unbalance of back pressure, which resulted in much more than half the gas passing through the lower layers.

(2) The premature drying out and consequent inactivity of a large proportion of oxide in the upper layers.

Other relevant conclusions and some possible explanations were:—

(3) Freshly filled towers gave high efficiencies. It thus appeared that suggestions of 'slip' of gas through defective joints, etc., should be discounted.

(4) Judging by the rapidity with which the efficiency of freshly filled towers fell off, drying and/or hardening of the oxide took place very quickly.

(5) Since temperatures of 100° to 110°F. were frequently reached by gas leaving first and second takers, it seemed likely that some decomposition of hydrated ferric sulphide had taken place—*viz.*,

$$Fe_2S_3 \quad H_2O \longrightarrow \quad Fe_2S_3$$

and/or

$$Fe_2S_3 \longrightarrow FeS_2 \text{ and } Fe_8S_9.$$

(6) In the upper layers of containers of a tower emptied after 210 days at work, the oxide around the central inlet main, and also towards the periphery of the container, was of higher sulphur content than that in the middle of the container. This may have been due to:—

(*a*) Cooler conditions at the centre and around the periphery, brought about by the proximity of the inlet main and the outlet annulus of the tower, respectively.

(*b*) The oxide may, during filling of the containers, have been a little more consolidated in the centre and at the periphery, thus initially retarding the flow of gas and so avoiding high local temperature; or, again, it may have been due to a combination of (*a*) and (*b*).

(7) The local hardening of oxide in contact with the grids of the upper layers was probably caused by local overheating brought about by the presence of the supporting grids, which restrict the surface area exposed to gas containing a maximum concentration of hydrogen sulphide.

The hard layer was more pronounced in the middle portion of the container—*i.e.*, midway between the centre inlet and the periphery.

(8) Drying out of the oxide seemed to have been due to the unsatisfactory temperature gradient, which did not favour sufficient condensation of water vapour within the oxide to maintain satisfactory moisture content. As previously stated, there was generally a continuity of temperature rise of gas on its passage through the towers right up to the fourth or fifth taker.

(9) It may be asked why the bottom layers were comparatively well fouled. There were probably two reasons, (*a*) the absence of local hardening in lower layers, and consequently better distribution of the gas, and (*b*) the moisture content of the oxide was maintained at a satisfactory level by condensation from the underside of the upper layer. It seemed likely that after a relatively short time of activity, the upper layers became inactive and consequently cool, and that condensate from the ingoing gas dripped on to the surface of the lower layer.

The appearance of the lower layers was consistent with this theory. There was usually a distinct crust on the surface of the layer, on which could be seen what appeared to be drip marks—circular indentations of a light rust colour.

(10) The tests with 15 in. layers of oxide in experimental purifiers of 0.5 cu. ft. capacity at normal *R* values showed very satisfactory purification. The inference seemed to be that, provided the gas flows with reasonable uniformity and at normal *R* value through the oxide, and provided satisfactory temperature conditions are maintained, good purification can be expected from six such layers in the varying stages of sulphidation experienced in large-scale practice.

Comparison with Towers at Sheffield

Following on the investigation already described, the authors visited, in February, 1951, the Neepsend, Sheffield, works of the East Midlands Gas Board, where an installation of six towers of similar dimensions to those at Nechells had been put to work in early December, 1950, and had been operating with satisfaction. It had been hoped to examine the spent oxide from the first tower to be discharged, but this was not possible.

By courtesy of the responsible officers of the East Midlands Gas Board, the available data were placed at our disposal, and they were compared with the Nechells records. The most significant difference between the operating conditions of the two installations was found to be the temperature gradient of the gas from inlet to outlet towers.

The reason for this difference became apparent when the quantities of heat liberated by the fouling and oxidation reactions in the two installations were considered; for it was then found that the heat generated within the towers at Sheffield was some 40 to 45% less than at Nechells. This was due in part to the lower hydrogen sulphide content of the mixture of coke oven gas, continuous vertical retort gas, and carburetted water gas purified at Neepsend, and in part to the considerably reduced volume of gas purified during part of the week. This period of reduced volume corresponded with the highest proportion of coal gas in the mixture, and therefore with the highest concentration of hydrogen sulphide.

It was also learned that it was the practice at Sheffield to use only mixtures of new and part-spent oxide. When a second visit was paid to the Neepsend Works, in June, 1951, a container of spent oxide recently removed from a tower was inspected. It was found that in contrast with conditions at Nechells there was no hard layer of oxide at the base of the upper layer. Differences of operating conditions having a bearing on this matter appeared to be (*a*) the use of mixed new and part-spent oxide, and (*b*) the lesser quantity of hydrogen sulphide entering unit area of oxide in unit time, with the possibility, therefore, of less intense activity in the reacting zone where gas first meets active oxide.

Remedial Measures

Resulting from the investigations undertaken at Nechells, from visits to the Wandsworth and Sheffield installations, and from discussions with representatives of the constructors and others, the following steps were taken:—

(1) With the double objective of preventing local hardening, previously referred to, and of replenishing the moisture content of the oxide, it was decided to charge a number of towers, as they became due for re-filling, with mixtures of new and part-spent oxides.

(2) With the object of replacing moisture in the oxide, it was decided to admit steam to the fifth taker and, in cold weather, to both fourth and fifth takers. Steam is admitted each day at the rate of 430 lb. per hour, usually between noon and midnight, but in very cold weather for the whole 24 hours.

This procedure has been found effective, certainly in the cooler months of the year. It is intended to make a further test to determine the effectiveness of the method in warm weather.

It was felt advisable to admit the steam to a tower earlier than the sixth taker, so that the oxide might have some time to cool before being placed into first-taker position.

In exceptionally cold weather, should a higher temperature be required in the first taker there may well be some advantage in admitting steam to the inlet sixth taker and thus heating the oxide, rather than pre-heating the gas.

Other types of oxide were tried.

Conclusion

Reviewing the progress made, and particularly on studying the records of individual towers, it is apparent that some towers gave a better performance than others. It is considered that this may have been due to variations of the mixtures with which the towers were charged. Tests recently made suggest that some of the part-spent oxide used may have been very unreactive. As much of this part-spent oxide was derived from towers operating under the earlier condition of high temperatures and dryness, this may well have been the case. If all the towers had performed equally with the best, the overall results would have been considerably better.

Some progress towards our objective can be recorded, but we are by no means satisfied with the working results so far achieved.

Proposals now in hand include:—

(1) Closer attention to the preparation of mixtures of new and part-spent oxides to secure a more uniform material of suitable reactivity, active iron content, moisture content and *p*H value. In this connection, it may be necessary to make provision for the aeration of the part-spent oxide before it is returned for re-use in the towers.

These matters may seem elementary, but cannot be fully achieved unless it be possible to extend the oxide-handling arrangements and provide means for better mixing of the constituent materials. The limited available ground space renders such an extension one of great difficulty.

(2) Trials are to be made using oxide in granular form in a layer next to the grids in the top layers of oxide.

(3) A trial is being made using a mixture of new and part-spent oxide in the deep single-layer baskets.

The capacity of the towers may prove too low, for although the volume of oxide allowed per 1,000 cu.ft. of gas (6.27) is very similar to that found satisfactory at Wandsworth, it is considered that purification duty should not be based on gas and oxide volumes alone, but should also have regard to the hydrogen sulphide content of the gas.

Consideration has been given from time to time to proposals for improved performance, which would involve substantial constructional modifications to the installation, or to the use of ancillary plant, but it is not the authors' intention to discuss propositions of this nature in detail at this stage.

There is evidence, which is strongly supported by experience at Wandsworth and Sheffield, that tower purifiers do operate far more successfully when the concentration of hydrogen sulphide is not greater than about 550 gr. per 100 cu. ft., and it is suggested that, where higher concentrations occur, it may be an advantage to introduce some method of primary purification of part of a stream, in order to reduce this concentration at the inlet towers to the requisite figure. The mixing of water gas with the coal gas, it is considered, would have a similar result where the quantity was regular and of sufficient proportions, but this is not possible at the Nechells works.

DISCUSSION

Mr. Charles Cooper (W. C. Holmes & Co., Ltd.) said they had the record of a purification system wherein the dimensions and design were not necessarily to be regarded as abnormal, but wherein there was presumed to be an intensification of effect in two directions. The first arose from high sulphur content in the gas and the second from a less opportunity of dispersing heat of reaction. The authors stated their finding that about 550 grains per 100 cu.ft. might prove the limiting content which they could purify (presumably at the rated capacity of the sets). The value of the paper lay in the fact that it might provide data for instituting such modifications of purification technique as might appear necessary to deal with high sulphur content of unpurified gas.

What was in fact proved was that inactivation had taken place of oxide in use, and the main purport of the work was to find the immediate causes of inactivation. It was agreed that such inactivation was not found in other similar sets of tower purifiers, and the number of these sets was now considerable. It was therefore the primary proposition that inactivation took place owing to uncontrollable loss of water, and that it arose from the heat effect overcoming the cooling effect of exposure, and the normal means used to retain water.

There was a general paradox, not resolved through the whole course of the paper. It was presumed that the initial hardening which took place in the oxide immediately above the grid of the upper layer caused unequal distribution of the gas between the layers, and yet in the long run the upper layer was found to be more denuded of moisture than the lower, as if a greater reaction and carrying off of moisture had thereby been effected. The contrary might quite well have been the case, so far as the analysis data indicated.

The authors had to define 'high sulphur content' in terms of the previously operated Wandsworth and the later Neepsend purifier sets, and also in terms of the sulphur content expected in this stream of gas when the work was projected in 1945. Nevertheless certain districts in this country had dealt with purification of gases considerably higher in sulphur content than the figures cited, and, in some horizontal retort gases, rising to nearly double.

Control of Discrepant Working

The sum total of the record indicated that the discrepant working might now be coming under control, but that even now it was necessary to admit that oxide previously treated, though still in use, was relatively inactive. It was difficult to see how the effects could be eliminated except over a considerable period of time. There was a certain amount of hope in this, as it suggested that the improvement recorded in the paper was not yet completed.

The failure to complete fouling in one operation was not necessarily final, but it might prove advisable to establish first the double fouling technique. Double fouling need not imply 100% extra handling.

The Nechells towers had each more volume than those at Wandsworth, by one-sixth. The conditions which procured retention of water were not simply to be stated in terms of heat *versus* exposed surface of purifier chambers (box or tower). In his opinion the improved results obtained by substituting an oxide layer of double depth did not necessarily provide the conditions for satisfactory operation. The moisture retention must be promoted and would not arise automatically simply by changing the form of the oxide bed.

He would like to set out the cycle of water content changes not claiming the merit of originality. The reaction $H_2S > H_2O + S$ under adiabatic conditions created water vapour but not enough to saturate the gas at the temperature at which the reaction ends.

The main intervening and interfering factor was the heat capacity of the oxide mass *plus* water content. Under adiabatic conditions the mass lost water to make good the requirement set up by the excess heat. The loss of water overall was of the order of half a ton to one ton per mill. cu.ft. for gases of high sulphur and assuming no manipulation. Addition of steam before the heat of reaction took effect did not affect the two circumstances already set out.

On the other hand, when the oxide mass was colder than the reacted gases its heat capacity would for some limited time prevent loss, and might promote absorption, of water.

The secondary intervening factor was the natural cooling and the subsequent loss of water from the system by condensation at points where it was not returnable to the oxide. Nevertheless, the cooler condition of the gas was gradually transferable to the oxide mass.

The sulphiding (a relatively mild effect) and the oxidation (a strong effect) do not coincide in place and time. Retention of water was therefore more attainable as an overall effect than as a local effect—*i.e.*, any one-box effect was usually either gaining or losing water. Attention was focused on the oxide mass as the balancing influence, to yield or to absorb water. Addition of steam after reaction was over could not in itself affect the conditions which caused net loss of water from the system, unless such steam addition created a temperature difference so that manipulation might procure partial reabsorption of water. All operations, therefore, of air addition, steam addition, and rotation, coupled with natural cooling effects, had to be applied to the creation of maximum temperature differences, and these temperature differences allowed the oxide mass to find itself in circumstances favourable to moisture retention.

If a static mass was being alternatively heated by a saturated gas and cooled later by a saturated gas at a lower temperature, the net result was retention of water however small in degree. The natural heat losses should not be considered only as adding to this effect but as a major contribution thereto. Thus if they had a mass of water at a certain temperature (say 90°F.) and they raised its temperature to 100°F. by passing through it saturated gas at 100° or higher, and they then reversed the process by passing through it gas saturated at 90° or lower, to arrive back at 90°, there would be an increment in the water mass.

The fact that the gas at Neepsend entered from an underground main in a cold state was probably a major cause of the difference of conditions observed. In his opinion the relatively low sulphur was the minor cause. Under adiabatic conditions the initial temperature was, or should be, of relatively little importance, but the fact of having an incoming stream of gas at low temperature assisted in procuring the possibility of large differences in temperature in the same purifier box in the course of a rotation, and therefore of a relatively high proportion of retention of water. The natural production of temperature gradient was artificially assisted by steam addition and also to some extent by the selection of the point for air addition.

Artificial Cooling

The suggestion was made that existing methods should be carried to a higher degree. The temperature changes which were favourable to moisture retention could presumably be created by introducing artificial cooling or artificial heating. He had studied the possibilities of deliberate cooling, either by introducing gas cooling elements, or even by taking out the oxide in its containers at 30 tons per parcel and submerging in cold water, thereby obtaining cooling and water addition at the same time. Addition of water by overhead sprays, together with cooling, was a further possibility and had been exploited elsewhere. Experiment showed that the absorption of water by partially foul oxide was really remarkably low, and in many ways these treatments were likely to be cumbersome and unsatisfactory.

On the other hand intermittent heating, which meant in practice heavy steaming of selected boxes, might prove wasteful in steam. This would, however, not be the case if the selected box could be temporarily by-passed, perhaps not entirely, so that the possibility of carrying away of water vapour by the gas stream would be minimised. It might be that the treatment of high sulphur gases by the oxide method, in boxes, would depend not only on the strict application of rules, but on intensification of the methods so indicated.

Mr. G. U. Hopton (North Thames Gas Board) remarked that the authors had given a detailed account of difficulties experienced in the use of tower purifiers. The two fundamental causes were the high content of hydrogen sulphide in the gas combined with a high gas load, and the use of new oxide. These two fundamental factors had one primary result—namely, a high heat release per unit volume of oxide. From this high heat release the observed phenomena arose.

With active oxide the zone of reaction was shallow. The more active the material the more shallow was the reaction zone for a given input expressed as weight of hydrogen

(*Continued on p. 711*)

sulphide per unit time per unit cross-sectional area. When the material within that zone had become inactive, the zone moved forward, so that at any moment only a small part of the total volume of oxide was engaged in reaction. The high temperature reached in the reacting zone, considerably greater than the temperature of the gas leaving the oxide mass, caused loss of activity due to dehydration of ferric sulphide, followed by decomposition to iron disulphide and magnetic sulphide, as was shown by Griffith and Morcom in 1945. The re-activation of dehydrated ferric sulphide by wetting could be achieved with some difficulty on the ground, but only to a small extent in the box. Iron disulphide and magnetic sulphide were very resistant to any treatment.

Thus, with split flow under conditions of high hydrogen sulphide load and active oxide, the oxide in contact with the grids at the gas inlet became caked, and uneven distribution of gas between the two layers occurred, particularly if the pressure drop across the beds was low initially. One layer became dry and inactive, and the volume of oxide in use was reduced practically to one half. The North Thames Gas Board had three installations of towers and tower boxes on order, and all had single-layer trays.

When purifiers were operated under high load it was dangerous to charge new oxide. Many works, such as Beckton, always charged mixtures of new and part-spent oxide. The attempt to work up new material to fully-spent in one or even two exposures was attended with considerable risk, desirable as it might be on some grounds. It was most important to take all practicable steps to avoid high temperatures. The assumption that gas leaving a purifier was saturated with water vapour was unjustified, since tests at Brentford had shown humidities as low as 75% between boxes, even at relatively low gas rates. Nevertheless, if a certain temperature rise across a purifier had to be faced, with the attendant loss of water from the oxide, it was better to work with a low inlet gas temperature in view of the increasing slope of the vapour-pressure curve. It would be noticed that the inlet temperature of the towers was 76°F. in November on full load. It would be of interest to know the ammonia content of the gas.

Other Precautions

Other precautions had been proposed, both in this and in earlier publications. It was desirable to rotate the vessels regularly and frequently so that what re-wetting did occur (limited though it was) might partially restore the condition of the oxide before serious drying out had taken place. The observation that finely atomised water sprays in the inlet gas main were ineffective in preventing drying out agreed with the findings of other workers. It might be thought that steam introduction would be of very limited benefit, since Clephane reported to the London and Southern Junior Gas Association in November, 1951, that steam admission at the inlet of second taker had very little effect on the moisture content of oxide, because there was normally a rising temperature gradient throughout the bed. Conditions were more favourable at the inlet of fourth or fifth taker, but it was doubtful whether the moisture lost in earlier positions could be replaced appreciably. Clephane was now carrying out experiments at Bow Common in which the box was shut out every month; the covers were lifted and water was sprayed over the oxide. The results were encouraging with artificial oxide which was fibrous and free from clay, and consideration was now being given to the installation of water sprays in the covers.

Another precaution in cases of overheating was second-stage air admission, which had been practised for some time, particularly on the works of the former South Metropolitan Gas Company. It must be realised, however, that the use of conventional boxes or towers was always difficult at high load. The introduction of liquid purification was particularly desirable on gas of high hydrogen sulphide content, whereas oxide was a very good reagent for modest concentrations such as followed certain liquid purification processes.

Mr. S. K. Hawthorn (Birmingham) said that if they compared a single box with a single tower it was evident that in a box the whole of the gas passed through a single layer of oxide 3 ft. 6 in. deep, but in a tower the entering gas was split into 28 parallel streams each of which passed through one 17 in. layer and each of those 28 streams was supposed to be equal in volume. This was a point where a big margin of error could creep in. If those 28 thin layers of oxide were not exactly similar in texture and packing and they did not remain similar for months on end, they could not share the work equally, and efficiency would be sacrificed. They could calculate a mean 'R' value, but the actual figures in individual layers might be widely divergent, and if only one or two layers were overloaded the performance of the whole tower might suffer. It was obvious, therefore, that more than ordinary care was needed in charging oxide into the several containers of a tower.

The authors had emphasised that if the H_2S concentration was high the heat of reaction could not be radiated quickly enough from the external surfaces of the towers. The temperature of gas and oxide became too high throughout the sequence of towers, moisture was progressively lost, and oxide dried out irregularly and lost activity. If H_2S concentration was moderate, heat loss could balance heat of reaction and suitable working conditions could be maintained, but an overload of H_2S upset the conditions. It would appear, therefore, that with H_2S concentrations over, say, 550 grains per 100 cu.ft., towers should be designed with higher 'R' value than boxes.

An alternative would be the provision of some type of primary purifier for part of the gas stream in order to reduce the overall inlet concentration of H_2S to the main towers. However, a purification system which required such assistance under certain conditions would have limited application.

Box purifiers erred on the side of allowing too much loss of heat of reaction, but this fault could be balanced by provision of limited lagging or of gas preheaters. In the case of towers it was very unlikely that preheaters would be required although live steam admission might be necessary to maintain an adequate moisture content in the oxide. It should be remembered that any internal condensation occurring on the inside of tower shells drained to the bottom and was lost to the gas; in boxes condensation on the underside of the lids dripped back on to the oxide and was conserved.

The H_2S content of gas at inlet purifiers was usually accepted as something over which the engineer had no control. The figure did, in fact, vary considerably from time to time on the same works for reasons that were not readily apparent. These variations could not be attributed solely to the sulphur content of the coal. Had they investigated sufficiently, for instance, the circumstances which influenced the formation of ammonia, CO_2, H_2S, and CN and their interaction in the gas stream before the purifiers were reached?

The Choice

When new purification plant was to be installed, engineers had to make a choice between boxes, towers, and liquid purification, and it was important to assess the claims of each type. The authors had indicated the savings in ground space with towers, but had also shown that oxide handling arrangements took up more room than originally allowed for. The manual labour involved with the Nechells towers was not less than with boxes, because two exposures would always be required and the actual operation of emptying containers was similar to that in boxes.

Mr. A. H. Saville (South Eastern Gas Board) commented that the first unit of tower purifiers was installed at Wandsworth in 1938. It was designed to treat 10 mill. cu.ft. per day and its performance was such that, some 10 years later, there was no hesitation in recommending that a second unit of almost identical design should be built. Since this second unit became available the load factor of both sets had been relatively low, but the original unit operated with a load factor of nearly 90% during the winter periods immediately after the end of the war and at all times there was definitely that ample reserve capacity which permitted the plant to operate with two and even three clean towers at the end of the stream.

The design of the Birmingham unit differed in one respect from that of the original installation at Wandsworth in that provision was not made at Nechells for the direction of gas flow to be reversed. This reversal of gas flow was not considered necessary for the second Wandsworth unit, but in view of the difficulty which the authors had experienced due to the hardening of the oxide immediately above the supporting grids of the upward working tiers, it now appeared that it would have been an advantage if the valving system provided on the original Wandsworth installation had been adopted at Nechells. This would have permitted the gas to enter the oxide containers either by way of the central tube or from the annulus surrounding the containers and should have contributed materially to more even fouling of the oxide layers.

The difficulty experienced with hardening of oxide immediately on the supporting grids of upward working oxide layers was one which was frequently met with in box purifiers designed for split flow. Although the hard lumps of oxide forming on these grids might contain 5% or 6% more sulphur than that forming the bulk of the oxide charge, restriction to gas flow had not in his experience been sufficiently serious appreciably to affect the overall fouling of the charge.

With the conditions of throughput and the oxygen content of the inlet gas which had applied to box purifiers at those works with which he had been concerned, it would have been most unusual for a charge to be fully fouled in one exposure even when using natural or artificial oxides of the highest activity; and in this respect he would submit that the experience with the box purifiers at Saltley was not typical of purification practice in the gas industry as a whole.

The authors quoted an example showing the rapid falling-off of efficiency for hydrogen sulphide removal of a tower in the Nechells installation over a period of some 66 days from 96% to 27%. A typical example of Wandsworth experience showed that a tower charged with a somewhat inactive artificial oxide operated for 120 days with a load factor of 87%, an average efficiency for hydrogen sulphide removal of over 90% and an efficiency at the end of the period of 88%. Throughout the life of this tower the inlet hydrogen sulphide content averaged about 400 grains per 100 cu.ft., the air added to the purifiers never exceeded 2½%, and the oxygen in the gas leaving the last tower was less than 0.5%.

Fouling in One Exposure

Over a number of years it had been found possible in the Wandsworth towers to foul oxide in one exposure up to a sulphur content of between 43% and 47%, the moisture ranging from 3% to 7%. There was, of course, some variation in the sulphur content of the various containers and in the oxide from different spots of any one container, but these differences were not of great magnitude, and 50 samples from the oxide in one particular tower showed a sulphur range of only 4½% with a moisture range of only 2%.

The gas temperatures on the towers at Wandsworth had always been appreciably lower than those quoted by the authors for the Birmingham plant and consequently the amount of moisture carried away with the outlet gas was correspondingly much lower. In fact, the gas temperature graphs for the Wandsworth installation more closely resembled those of the Saltley box purifiers than the Nechells towers and it was usual at Wandsworth for the gas to leave the towers at almost the same temperature as that at which it entered the unit. He would agree with the authors that the considerable temperature rise experienced at Nechells was a very important factor, as it not only resulted in loss of moisture from the system but might also reduce permanently the activity of the oxide and thereby lead to uneven fouling of the charge; and in this connection he suggested that a substantial reduction in the proportion of air added to the system might have far-reaching effects.

The authors had stressed the fact that the surface area available for the dissipation of the heat of reaction was considerably less for towers than for orthodox boxes, but it would appear that the examples quoted were not comparable because the comparison had been made between towers each capable of holding 210 tons of oxide and box purifiers with each box holding only 100 tons of oxide. If the figures were calculated for deep boxes holding 200 tons of oxide, then the surface area for towers was not materially different to that of deep boxes. Further, it was not unusual for purifiers in exposed situations to need to be protected from severe weather by some sort of lagging and in general it would normally be considered an advantage to have a small exposed surface area rather than a large one.

Until further investigation had been made into those differences which existed between tower purification practice at Birmingham on the one hand and at Sheffield and Wandsworth on the other—and among those differences he would mention load factor, operating temperature, bulk density, and activity of purifying material, and also the oxygen content of the gas—it would be unfair to suggest that for successful operation the use of tower purifiers should be confined to those gases which contained less than 550 grains of hydrogen sulphide per 100 cu.ft.

Mr. John Bateman (Sheffield) said that in starting up a new installation they in Sheffield believed it was advantageous to fill the towers with mixtures of oxide containing graduated percentages of sulphur, as in this manner it was much easier to bring the towers into a proper working sequence than if they started off with all new oxide.

In drawing comparisons with Sheffield there was one important omission. They had an extensive oxide handling plant which ensured correct mixing of oxides and even filling of the containers. They believed this factor to play an important part in the successful operation of tower purifiers.

In regard to aeration of part spent oxide, it was noteworthy that at Sheffield the oxide passed direct from the container being discharged to the container being filled in one flow line, sufficient aeration being obtained by passing through a disintegrator en route.

In reaching their conclusions the authors made a highly controversial statement with which he disagreed, and he would ask what was the evidence that showed that tower purifiers operated far more successfully when the concentration of H_2S was not greater than 550 grains per 100 cu.ft.

It was true that in the towers at Sheffield they purified varying proportions of carburetted water gas, and their average H_2S content was 550 grains per 100 cu.ft. However, this was only by force of circumstance and not because they thought the towers would not do more. On the contrary, there were prolonged periods last summer when little carburetted water gas was being made at this works and the towers were taking their full capacity with an H_2S content of a maximum 720 grains per 100 cu.ft. No falling off in efficiency was noted under these conditions.

They were delighted with their tower purifiers and, equally important, the men were delighted with the greatly improved working conditions. Any engineer responsible for putting a tower installation to work need have no worries regarding successful operation.

Two Main Approaches

Dr. L. A. Moignard (Gas Research Board) remarked that two main approaches were possible to oxide purification at present. In one, the operational aspects were tackled, and this was necessary when dealing with conventional purifiers. In the other, chemical and physical limitations were accepted to a greater degree, and mechanical and structural engineering was relied upon to deal with the outstanding problems. Tower purifiers were an example of the latter approach. Their many advantages of economy in ground space, speed of changing, uniformity of labour demand, might have obscured a point which he felt was clearly brought out in the paper—namely, that a tower purifier was no more than a deep multi-layer box of, at present, unusual design. With towers, loss of activity, drying out, and hardening would still occur, and the plant might be in some ways more sensitive to them so far as they affected the working of the oxide within the vessels as distinct from the handling of it outside.

The authors had, of course, appreciated this; for, considering the contrast between the results obtained at Nechells on the one hand and at Wandsworth and Sheffield on the other, they had rightly decided that the solution was not to be sought in details of design or of the nature of the fresh oxide used. It was at first sight a surprising conclusion that heat dissipation was less easy with the towers than with the boxes with which they had been compared, when one considered these tall unenclosed structures. As a basis of comparison, he would himself prefer to relate the superficial area to the rated throughput, to which the rate of heat production was proportional, and then towers and boxes seemed almost equal (6,160 and 6,510 sq. ft. per mill. per day). This pointed to the importance of the outer annulus as an insulator and led one to wonder whether the details of its design would make it possible to spray water down it, thus cooling and humidifying the gas.

If they regarded a tower as a species of deep box, they would expect to find that hardening occurred as readily and in corresponding places. It had, of course, been a criticism of deep boxes with upward flow in alternate layers that there was hardening on the grids, and some such sets were accordingly provided with means for reversing flow direction. Back pressure appeared to be a minor problem in both installations. In the towers, which might be regarded as 28 sets of six small boxes in parallel, restriction in gas flow due to hardening in one layer would not be apparent since gas was diverted elsewhere.

Abstract of Comm. No. 409

Gas Supply to Four New Towns

by

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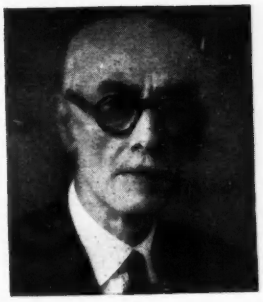


OF the four new towns in the Watford division of the Eastern Gas Board, not one is large enough to justify a new works solely for its own purposes. Furthermore, concurrent development in neighbouring towns has also to be taken into account. Nationalisation of the industry inevitably means the ultimate concentration of manufacture, wherever possible, into units of about 8 to 10 mill. cu.ft. a day capacity. Only at Hemel Hempstead will a manufacturing station at 3 mill. cu.ft. a day capacity be considered, and then only because development at the St. Albans works of the Board has been restricted.

The supply of coke is still an important side of the gas industry's business, and the cost of delivery is a factor that tends to outweigh the economics of centralised manufacture.

In estimating the number of dwellings in the Watford division, it was assumed that there will be an average of 3.5 persons per dwelling, a figure used by the planning authorities. A more difficult problem was to determine the number of new domestic gas consumers. It was assumed that the householder would be given freedom of choice in regard to the selection of gas or electricity for domestic purposes, although at one time it was not certain that this would be the case.

District Heating

It was natural that the architects of the new towns (the word 'architect' is used here in its broadest sense) should seek to incorporate in their plans all the best features of the art of town planning as they saw them, and one of these features was district heating. So much had been said about district heating in recent years (the Ministry of Fuel and Power had sent a Committee to the United States of America to investigate the systems in use there) that the Development Corporations would have been thought wanting if they had not given consideration to this method of providing hot water and space heating in the new towns. They were not long in coming to the conclusion that district heating was going to prove much too costly for the average tenant unless the scheme was to be subsidised; and a subsidy appeared to be out of the question. In any case, of course, electricity would be required for lighting, and gas or electricity for cooking, but the lack of the opportunity for either of these services, after making provision to meet the peak demand, to extend the use of its commodity for water heating, refrigeration, and some space heating could not be contemplated without concern.

Freedom of choice is now the practice, and the Development Corporations are, in the main, carcassing all houses to enable either service to be used. In most houses, gas points are provided for sink water heaters and refrigerators, and in the case of Stevenage for geysers in the bathrooms. At Hatfield and Welwyn Garden City new towns refrigerators are being fitted as house fixtures, and at Hatfield sink water heaters in addition.

Before the Second World War, where there was freedom of choice the percentage of dwellings using gas for domestic purposes in the area of the former Watford and St. Albans Gas Company was not less than 90, and there was little evidence of electricity making serious inroads into this field. Throughout the war, existing domestic consumers of gas or electricity were not allowed to change from one service to the other, and as no new houses were built between 1939 and 1946 there was little guide as to where the householders' choice would lie. It was felt that while the high pre-war percentage would suffer some reduction, there was still a majority in favour of gas, and, somewhat arbitrarily perhaps, it was decided to base the estimates on the assumption that 75% of all new householders would use gas for cooking, laundering, and some water heating, and experience shows that this percentage is being maintained or exceeded.

In Hemel Hempstead new town nearly 80% of the occupants of new houses have chosen gas for cooking, and altogether in the four new towns and the London County Council estates just over 75% of the 5,200 houses completed and occupied at the end of January, 1952, are equipped with gas cookers.

One of the recommendations of the Simon Report is that a smokeless solid-fuel appliance should be installed in each new dwelling, and in the main this recommendation is being implemented by the installation of a gas-ignited coke grate with back boiler. While this appliance will provide a market for coke, it may tend to reduce the gas demand for water heating.

The practice of installing gas-ignited smokeless solid-fuel appliances in nearly all post-war houses brings the percentage of gas consumers up to nearly 100, and this should be borne in mind in future years when considering the consumption of gas per consumer.

Gas Demand

The next problem was to form an estimate of the average consumption of the domestic consumer. Here again the war years somewhat violently disturbed the pre-war trend. In common with many other places, the consumption of the domestic consumer in the Watford area increased considerably during the war years. The average consumption of the domestic consumer increased from 106 therms in 1939 to 152 in 1947, since when there has been a drop in each year. The average consumption for both classes of consumer (ordinary and prepayment) in the year ended March 31, 1951, was 136 therms. The estimated demand in the new towns was made in 1948, and the figure taken was 150 therms per domestic consumer. It was realised at the time that this consumption may be unduly inflated through the shortage of solid fuel and to over-crowding due to the cessation of building during the war years. Some drop might, therefore, be anticipated, but the reduction in consumption is greater than the alteration in these two factors. Solid fuel is in no better supply and the reduction in the persons per household, due to new housing, is insufficient to cause the whole reduction. It is more likely that other items of family budget are competing for resources which in terms of commodities appear to be suffering a gradual and progressive reduction in value.

The magnitude of the annual demand of the domestic con-

sumer has an important effect on the magnitude of the maximum day when considering the domestic load only. Where the annual demand is at a high level, the extra consumption is mainly due to the space heating load. While, therefore, the present tendency is for the annual demand to suffer some reduction which may continue until the housing demands of the population have been met, if we design our distribution systems in the new towns to meet an average consumption of not less than 150 therms per annum for the domestic consumer we may safely say that we have anticipated a demand not likely to be exceeded, but which, on the other hand, has been experienced and is therefore again a possibility.

The non-domestic (*i.e.*, industrial commercial, etc.) is more difficult to forecast than the domestic demand. The new towns are to be self-contained communities with sufficient industry to employ the working population, and industry will be varied in character in order to provide diversity of employment. The trend is definitely in the direction of the non-domestic user taking an increasing proportion of the total gas demand, and it is not reasonable to assume that the non-domestic demand in the new towns will be similar to that obtaining in Letchworth and Welwyn Garden City, which is confirmed by experience in the Watford group over the past 15 years, when of the total increase in demand 43.2% was due to the non-domestic consumer.

When these facts were first considered, the average consumption of the domestic consumer in the Watford group was 150 therms per annum, and it was decided to make provision for the non-domestic consumption to be equivalent to the domestic demand—*i.e.*, 50% of the total demand.

The annual consumption of the domestic consumer is now tending to fall, whereas the non-domestic consumption is still rising. The same provision is still being made for the non-domestic consumer, but it is expressed as 32 therms per head of the population. This figure is used for all new development, including the new towns, except that which is obviously rural.

Location of Works

Of the total gas estimated to be required in the division at the end of the 20 years development period, 26% will be required in the new towns, and of the additional gas, taking the year 1948 as a deadline, about 43% will be required by them. As the integration of all manufacturing stations will shortly be completed, the requirements of the new towns cannot be considered independently, but as part of the whole framework.

Twelve manufacturing stations were in operation at vesting date. Two small stations have been closed down, and two more will cease gas-making before the end of 1952, leaving eight in operation. These eight works range from just under 1 mill. to 15 mill. cu.ft. a day capacity. It is the ultimate aim to have only five works in operation—namely, St. Albans, Watford, Hemel Hempstead, Luton, and Hitchin. The first three will form the Watford group, and the last two will manufacture the requirements of their respective groups. The closing down process may take some time, if only because new works are taking so long to build. The remaining works are, however, producing gas economically, and when integration is completed and they run as base-load stations, further economies will be made.

With present gas-making technique, no case could be made for concentrating manufacture at one works. The cost of coal at Hitchin and Luton is 2s. a ton less than at St. Albans and Watford, equivalent to 0.32d. per therm of coal gas. The difference is not sufficient to justify the concentration of manufacture at Luton and Hitchin, and it provides an even stronger reason against concentration at St. Albans. It is believed that the best case is made for gas to be manufactured at all these places, with the retention of the works at Hemel Hempstead.

The Watford group comprises the former Watford and St. Albans Gas Company, the Chesham undertaking, which has been supplied in bulk for a number of years, and Berkhamsted. The St. Albans Works now manufactures 60% of the total demands in the group, and it is here that most of the additional requirements of the group will be produced.

The Luton group comprises Luton, Dunstable, and Woburn Sands. The small works at the latter place is shortly to be closed down and supplied from Luton, leaving the present Luton works, of 5.6 mill. cu.ft. a day, and Dunstable, of 1.5 mill. cu.ft. a day, in operation. The gas demand in this group is expected to reach about 12 mill. cu.ft. a day in 1968. The works at Luton, which is barely able to meet the winter load, is very congested and cannot be expanded. A new site is required on which to construct a works ultimately to supply the whole group. Although difficulties have been encountered in finding a new site, negotiations in progress will, it is believed, lead to the acquisition of an excellent site just outside Luton and on the main-line railway. Dunstable is running as a base-load station feeding its surplus gas into Luton, which has also been connected to the St. Albans high pressure system, from which gas will be supplied as the demand grows and until a new works has been constructed.

The Hitchin group comprises Hitchin, Letchworth, and Baldock. Works are in operation at each place, but Baldock, which produces about 60 mill. cu.ft. a year, is being closed down in about six months time. A new works is to be constructed at Hitchin to meet the total demand of the group.

The total gas requirements in the division are estimated to be 11,700 mill. cu.ft. per annum by 1968. While it is intended to produce most of the gas required by each group within its own boundaries, during the winter months and while plant is undergoing repair gas will be transmitted from one group to another.

Proposals are to manufacture in accordance with Table I.

Table I.—Gas Production Planned for the Watford Division of the Eastern Gas Board.

Group	Demand 1968 Group Total	Demand 1968 Max. Day	Production in 1968 (Mill. cu. ft.) Coal Gas	C.W.G.	Oil Gas	Production on Maximum Day (Mill. cu. ft.) Coal Gas	C.W.G.	Oil Gas	Total
Watford ...	7,084	31·0	5,625			18·0	8.6	4·0	30·6
Luton	2,696	12.0	2,500			8·0	2·5	2·0	12·5
Hitchin ...	1,937	8·6	1,875			6·0	2·5	Nil	8·5
Total for Division ...	11,714	51·6	10,000	1,684	30	32·0	13·6	6·0	51·6

Stanier and McKean have described* a process for the production of town gas by the catalytic gasification of petroleum oils. If this process proves to be satisfactory in practice, producing gas with characteristics similar to coal gas, then the amount of peak-load gas could, with advantage, be increased to about 10 mill. cu.ft. a day and the carburetted water gas percentage correspondingly decreased, thereby effecting a saving in capital on plant having a low annual load factor.

To carry out the above programme of manufacture, 8 mill. cu.ft. capacity of carbonising plant will be required at Luton, and 6 mill. cu.ft. at Hitchin, with 2.5 mill. cu.ft. of carburetted water gas plant at each works. The production of 4 mill. cu.ft. a day of oil gas in the Watford group can, it is anticipated, be installed without difficulty at St. Albans, or possibly divided between St. Albans and Watford, and a further 2 mill. cu.ft. a day capacity installed at Luton. It will be seen that the manufacturing programme set out for each group would, on the maximum day, almost equal the requirements of the group. Some gas would be passed from one group to another, particularly as the load steps up in the autumn and early winter months and decreases in the spring. As carburetted water gas plant is brought into production the aim in the system would be to avoid having two or three plants on partial load.

The coal gas and carburetted water gas plant required for the Watford group is installed or on order.

* Stanier, H., and McKean, J. B. 'The Production of Town Gas by the Catalytic Gasification of Petroleum Oils.' *Inst. Gas Eng. Comm.* 375.

(*Continued on p. 723*)

To provide the gas requirements of Stevenage for a period of about six years, the St. Albans high pressure system is being extended by 3.5 miles of 12 in. dia. spun iron main with flexible joints. Subsequently, the town will be supplied from a new works at Hitchin through a 15 in. dia. cast iron main working at a maximum pressure of 5 lb. per sq. in., and an average pressure of 2 lb. per sq. in. Two 1 mill. cu.ft. capacity three-lift gasholders, equivalent to 50% of the maximum day demand, are to be constructed on a site selected by the Development Corporation in the industrial area.

Regarding Hemel Hempstead, an 18-in. and 15-in. trunk main connects St. Albans with the North Watford holder station and the Hemel Hempstead works. This main, which was laid in 1930, is of cast iron with spigot and socket joints and will be worked to a maximum pressure of 5 lb. per sq. in. Of the additional 4.22 mill. cu.ft. required on the maximum day in the Hemel Hempstead sub-district the present main can deliver 2.35 mill. cu.ft. to Hemel Hempstead. The section of this main between Watford and Hemel Hempstead supplies districts *en route*, with the result that the gas delivered into the Hemel Hempstead gasholders will vary from hour to hour during the day. At the inlet to the holder, the main will be suitably governed to maintain a predetermined pressure at the governors supplying these districts. Of the 767 mill. cu.ft. per annum required from the St. Albans works, this main will supply about 690 mill. cu.ft. By 1958, if development proceeds along the lines anticipated, a new main will be required to supply the 1.87 mill. cu.ft. on the maximum day, which is beyond the capacity of the present trunk main. This main will have a low annual load factor, as it is estimated that it will only be required to deliver about 78 mill. cu.ft. per annum, although the tendency will obviously be to divide the load between the two trunk mains as far as possible. In view of the low annual load factor, the costs of delivering gas through mains varying in size from 4 in. dia. to 12 in. dia. were estimated. The 12 in. dia. cast iron main was selected, as it is of an economic size to supply all the additional requirements of the sub-group in the event of the works at Hemel Hempstead and Berkhamsted being closed down.

The distribution system in the new town will be centred on the gasworks, as at present.

Additional Storage

The storage capacity of the existing gasholders is 700,000 cu.ft. To provide storage equivalent to 50% of the maximum day, the total holder capacity required is 2.1 mill. cu.ft. A new 1 mill. cu.ft. capacity gasholder will be completed in 1956, and a second holder of the same capacity will be added towards the end of the development period, by which time one of the two existing holders will have outlived its useful life.

Turning to Welwyn Garden City and Hatfield, the existing high pressure ring main is of 8 in. dia., with the exception of a short length between Welwyn Garden City and Hatfield, which is of 6 in. dia. The new 12 in. dia. main recently laid extends from St. Albans to Welwyn Garden City, picking up Hatfield *en route*. When development is complete, this high pressure system will operate at a maximum pressure of 18 lb. per sq.in.

There is, at present, a gasholder of 250,000 cu.ft. capacity at Welwyn Garden City. A holder of 1 mill. cu.ft. capacity will be erected in 1953, and a second holder of similar capacity will be provided as development proceeds.

There would appear to be no reason why in a new town the gas undertaking should not manufacture producer gas, at least for the industrial consumer, by the erection of producer gas plants in the industrial area of the town. If Stevenage be taken as an example, our estimates provide for an industrial demand of about 2 mill. therms per annum. A large industrial concern in the divisional area is producing and using in its factory rather more than this quantity.

The use of producer gas for domestic purposes may be more problematical, but it would appear to be a subject well worth investigation.

DISCUSSION

Mr. T. C. Battersby (Eastern Gas Board) remarked that, because of either the geographical attractions or the exemplary characteristics of its natives, Hertfordshire had been selected for the siting of four new towns and two not inconsiderable L.C.C. estates. These, together with the expanding model towns of Letchworth and Welwyn Garden City, and the expansion of established towns, threatened Hertfordshire with a development problem which was unlikely to be equalled by any other county. The author reminded them that in the last inter-censal period the population of Hertfordshire increased by 52.4%. During that period a considerable proportion of this growth was borne by the former Watford and St. Albans Gas Company, and today the Watford division had the task of satisfying the demands of these new communities.

The author had given a complete picture of the technical and economic aspects associated with post-war development, and how the many pieces were fitted together to make a composite whole. Mr. Battersby would like to record the close and valuable co-operation they were enjoying with all the planning authorities, but, as the phasing of their expansion could only be related to the best estimates, their plans must be designed to preserve the utmost flexibility at every stage.

As they knew the ultimate capacity of each town, and could form a reasonably reliable estimate of the gas requirements, the plans must provide for this, and they therefore incurred, in the earlier years, capital expenditure far in excess of what could be justified by the immediate revenue. Therefore, the Eastern Gas Board, with four new towns in the Watford division and one in the Tottenham district to supply, was carrying a burden which would have an adverse effect on its finances for many years. During the earlier years, the capital charge per therm of gas sold would vary according to the nucleus population of these development centres, and it had been estimated that in the case of Stevenage the cost of servicing capital, based on 1950 charges, would rise as high as 7½d. per therm of gas sold.

Sharp Contrast

While it must be conceded that planned development had much to commend it, as far as they knew precisely the ultimate saturation of these designated areas, and could form a reasonable estimate of the gas requirements, planning now was in sharp contrast with past practices. Hitherto, it was the habit to look ahead a few years and lay such mains as were likely to meet the position for a time, and recognise the fact that subsequently they would be augmented as circumstances arose. This could hardly be regarded as satisfactory, but it had the merit of keeping down the immediate capital expenditure.

He was pleased that the author has stressed the importance of paying due regard to the low capital charges on their pre-war assets. The former Watford and St. Albans Company took more than 100 years to expend a million pounds of capital, and today the same group of undertakings would be expending capital at the rate of more than one million pounds a year if the materials were available.

The author had demonstrated that schemes for centralised manufacture must show a substantial gain in efficiency and economy of operation to carry the heavy capital charges of new plant, the obsolescence of abandoned works, and the extra cost of transporting coke. He appreciated that every case had to be judged on its merits, but there was a tendency to regard the centralisation of manufacture as the obvious solution of their problems. It was his view that many of the smaller works should be retained for some years, and operated as base-load stations, drawing their additional gas requirements from a parent works.

After more than 20 years of close association with Mr. Evetts, studying and discussing such problems as he had propounded in his paper, it was not surprising that he was in complete agreement with him throughout the greater part of his text, and it was only when he referred to coke *vis-à-vis* complete gasification that he found himself less closely identified with the author's views. He was not surprised that Mr. Evetts should invoke the aid of the Gas Act, and suggest also that they might have an obligation to develop and maintain the production of coke. He went even further and considered that the industry should state unequivocably its intention to meet the growing demands for coke, in order that the housing authorities should be confirmed in their minds that they were showing the right policy in fitting coke-burning appliances. He was not sure that these appliances were for the exclusive use of coke.

He preferred to regard them as improved solid-fuel burning appliances capable of burning low-grade slacks or briquetted materials.

It was, therefore, something of a shock to read that Mr. Evetts was prepared to consider the possibility of supplying producer gas to the industrial areas of the new towns. If he was to meet half the gaseous requirements by producer gas, how would he meet the potential coke consumer who claimed that they had shown undue discrimination and denied him his promised coke requirements? Whatever his answer might be, he applauded his change of outlook, because there was a real danger of losing the load of the very large industrial consumer unless they could reduce their prices.

Perhaps the author would tell them how he proposed to dispose of the residual tar. Would they also have to be purveyors of steam raised in tar-fired boilers? Had he included a gasholder in these costs, because there would be a wide variety of industries each with their peculiar demands?

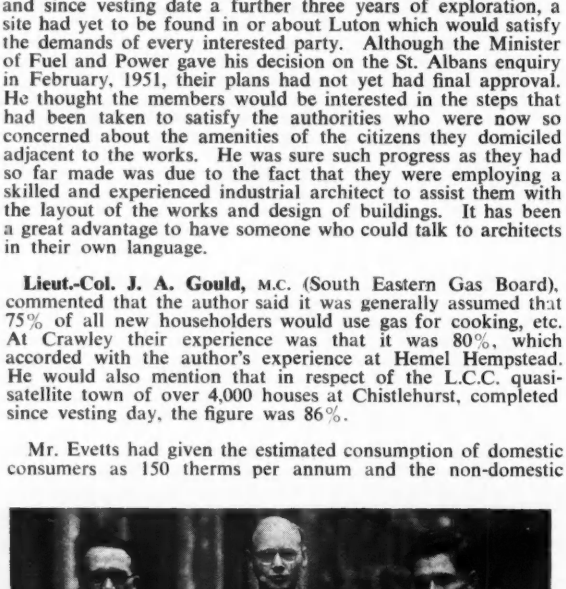
He imagined that when the consumers realised that a lower value gas than was traditionally supplied and at a lower cost per therm could satisfy their requirements, there would be some overcrowding in the industrial zone. The commercial bread baker would certainly want a site there. This was a fascinating problem worthy of detailed investigation where new development was concerned. The author had gone a long way with him, and he thought now that Mr. Evetts was prepared to share his views that complete gasification must be their ultimate aim.

Dignified Restraint

Mr. Evetts had shown a dignified restraint in his reference to the legislation which surrounded works development. Following the efforts of the Luton Gas Company to find a works site, and since vesting date a further three years of exploration, a site had yet to be found in or about Luton which would satisfy the demands of every interested party. Although the Minister of Fuel and Power gave his decision on the St. Albans enquiry in February, 1951, their plans had not yet had final approval. He thought the members would be interested in the steps that had been taken to satisfy the authorities who were now so concerned about the amenities of the citizens they domiciled adjacent to the works. He was sure such progress as they had so far made was due to the fact that they were employing a skilled and experienced industrial architect to assist them with the layout of the works and design of buildings. It has been a great advantage to have someone who could talk to architects in their own language.

Lieut.-Col. J. A. Gould, M.C. (South Eastern Gas Board), commented that the author said it was generally assumed that 75% of all new householders would use gas for cooking, etc. At Crawley their experience was that it was 80%, which accorded with the author's experience at Hemel Hempstead. He would also mention that in respect of the L.C.C. quasi-satellite town of over 4,000 houses at Chistlehurst, completed since vesting day, the figure was 86%.

Mr. Evetts had given the estimated consumption of domestic consumers as 150 therms per annum and the non-domestic load as equivalent to 112 therms per domestic consumer, making a total of 262 therms per consumer. It was clear that the non-domestic load anticipated by Mr. Evetts and based on the experience in the Watford division was considerable. It would appear that the relationship of the maximum day's demand to the annual demand was an average of about 1/225, which was a greater fraction than that commonly applying to existing supplies in south eastern England. He agreed with the author that 20 cu.ft. per consumer was a good figure to take as the maximum hourly demand in designing the distribution system.



J. G. 4379

E. B. Craddock (Aylesbury), S. Ashworth (Wirral), and J. Gadd (Aylesbury).

In referring to the intention to use an 18 in. and 15 in. cast iron (presumably lead jointed) main laid in 1930 to give the supply to Hemel Hempstead, the author referred to the necessity for working these mains at a pressure of 5 lb. per sq. in. Was any consideration given to the question of clamping the joints? The author referred to the possibility, due to the shortage of steel, of constructing a pre-stressed concrete tank at Stevenage. Could he give them any idea of its cost compared with that of a steel tank?

It was interesting to see that the use of radial feeder mains was found desirable in preference to ring mains. The choice was influenced, among other things, by the location of the holder station. At Crawley a ring main was chosen; the holder station there was situated almost on the boundary of the new town. Having regard to the fact that the author examined the economics of feeder main systems at Stevenage designed to operate at either 30 in. or 60 in. maximum pressure, it would be instructive to know if he considered a ring main at the higher pressure.

In regard to boosters, the author referred to the series working of his machine so as to secure the peak load pressures on Sunday. Would he say if he had only two machines? At Crawley it was proposed to provide three machines of the same capacity, two of which would take the peak and give a differential of 60 in. W.G., the other being a spare.

District Governors

It was noted that 18 district governors would be used to supply Stevenage, whereas at Crawley, where the town was divided into nine neighbourhoods, there would be one governor for each of these and an additional one to supply the industrial district. Each of the ordinary governors would be mechanically clock controlled and fitted with double cam mechanism giving week-day and Sunday pressures, whereas that for the industrial supply would be fitted with triple cam mechanism, as it was felt that a wider control of pressure conditions throughout the week might be helpful in the future.

Having in mind the large number of governors to be used at Stevenage, he assumed Mr. Evetts had no fears about balancing the pressures to avoid hunting between adjacent governors.

He was particularly interested to read of the arrangement by which the mains were being laid in the front gardens of the houses. Although this was not being done at Crawley, it was a practice the use of which was gradually extending in Kent and which lent itself to supplies to municipal estates. He would like to know what form of easement the Eastern Gas Board had agreed with the development corporations concerned in respect of these mains. They found that the cost of feeder mains was about 35% of the cost of the estate mains at Crawley, which was in general agreement with the author's figures.

After reading the paper one could not help reflecting on the advantages of new towns to the engineer from the point of view of planning of mains and storage. He compared the position with the difficulties which existed in the early 30's when considerable building development was rapidly taking place, usually under no town planning scheme, and at any part of the district where land could be readily acquired. In those circumstances planning was extremely difficult and to some extent chancy. It was interesting to compare the amount of mainlaying work executed then to the present time. Thus, from the statistics in the second report of the Gas Council they found that the average length of main laid per area board during the year ended March 31, 1951, was 123½ miles, the length for the whole of the Eastern Gas Board's area being 95 miles and for the South Eastern Gas Board 124 miles.

So far as the new towns in the Watford division were concerned, Mr. Evetts showed that approximately 1,750 houses

(*Continued on p. 727*)

would be erected each year. Assuming that 15 yards of main, including trunk mains, would be required per house, the total length per annum would be about 15 miles. Let them compare those figures with the long lengths of main laid by many gas undertakings during the building boom referred to. For instance, quoting the experience of the South Suburban Company, in which he served before the vesting date, an average of 81 miles of main per year was laid from 1933 to 1936, both inclusive, 41,000 consumers being added during this period.

Dr. G. Milner (Power Gas Corporation) said that gas prices, for both domestic and industrial uses, in many parts of the country were dangerously high when compared with competitive fuels in the particular spheres of application. While it was, of course, appreciated that gas was not sold on its cost basis alone, cost was one of the most important factors. In the industrial field during the last war and in the post-war period, the increase in the amount of town gas used in industry was phenomenal, but there were signs that it was going to receive very fierce competition from oil, especially when the present refinery construction programme in this country was completed. Oil on an equivalent basis to gas at rates of round about 10d. per therm or lower was what they were now having to face.

There were signs that they could not count on obtaining in the future certain industrial and process loads which they had taken for granted during the last few years. Then there were advances in the utilisation of electricity, and he need only refer to high and low frequency induction heating. He thought, therefore, that the author's suggestion of using cold clean producer gas in a compact industrial zone, built up literally from green fields such as obtained in a new town, should be seriously considered. It was suggested that short of complete gasification there was little that the gas industry could do by the established methods of production to increase the process efficiency and to lower costs.

There were indications from all sides today that the minds of those people responsible for designing gas production plant were looking beyond the orthodox methods hitherto accepted as standard, particularly for peak load gas production.

Producer Gas for Industry

It was often stated that producer gas could not compete with town gas in industry due to flame temperature and other characteristics, and for a number of other reasons. Nevertheless, it was true to say that there were many industrial processes which could use efficiently the type of gas mentioned in the paper. The experience of the industry in the last war in the operation of producer gas plants as an emergency alternative to town gas in factories or as a fuel supply to many new factories brought into commission in areas where there was either no gas supply or the local gas undertaking was already heavily committed, showed what could be done by this fuel.

He would refer briefly to the author's example of a factory in the Watford division manufacturing and consuming 2 mill. therms per annum of cold clean producer gas. He had been intimately connected with that factory for many years. Prior to 1941 it was taking town gas to the amount of 1 mill. therms per annum, gas being used for a full range of heat treatment processes from tool hardening furnaces at 1,400°C., carburising at 980°C., hardening at 900°C., rivet heating furnaces for paint drying ovens, and for many other purposes. Most of this equipment was thermostatically and automatically controlled. In 1941, for a number of reasons not germane to the paper, it was decided to use producer gas. The plant incorporated equipment to produce gas of the required standards of purity.

At the time of the conversion, which, it would be appreciated, was a major operation and covered a multiplicity of appliances, doubts were expressed as to the proper functioning of a number of these items, but apart from the usual teething troubles in setting such a plant to work, the factory executive and operatives had always expressed themselves extremely satisfied, and are unlikely to change in this respect.

Mr. C. A. Deas (Eastern Gas Board) said that in addition to the duties placed upon them by the Gas Act, boards had an obligation via the Ministry of Fuel and Power coke programming machinery to see that those consumers who had need for a coke supply, whether as traditional users or as consumers for the first time, were supplied with their needs. It was also necessary to have regard to the fact that gas boards had a responsibility towards the coke requirements of the whole

G. J. 4359

H. C. Broadbent (Liverpool), W. T. Hainsworth (Oldham-Rochdale), and R. Lockett (Rochdale).

of their area and not just those towns and places where coke was actually produced.

As the author stated, the Simon report had done much to encourage the provision of improved types of solid fuel burning appliances in new houses. These appliances would, however, burn other fuels than coke, and therein lay the danger that the industry might well find that what was a legitimate market for coke passed over to other fuels.

It had been suggested that the industry could not supply sufficient coke anyway for these additional domestic appliances without deliberately breaking down some of its large coke, but a recent coke sizing survey carried out by the technical section of the Gas Council Coke Department had shown quite clearly that the so-called large coke contained anything up to 50% of sizes which, with improved screening efficiency, could be made available to the domestic market.

They would do well to remember also that, whether they liked it or not, the industry would have to carbonise increasing percentages of low rank coals in order to conserve the high rank strongly caking coals for the steel industry, and the result would be an increasing preponderance of the smaller sizes of coke, the most suitable outlet for which was the domestic market. Hence the need to do everything possible to foster and retain this market for the future.

A Vulnerable Market

The industrial market which used large coke was more vulnerable to competition from cheap low grade smalls burnt in underfeed stokers, and at present prices of coke and oil the latter was not by any means out of the picture, particularly on the larger installations where the use of oil-burning equipment could show definite labour saving.

It has been contended that water gas was cheaper than coal gas. A factor which was often overlooked, however, was that the production of additional water gas in a district where the coke output from the existing carbonising plant was already being completely absorbed locally might mean that coke had to be brought into the district, incurring rail tolls or other cartage charges of no little significance.

If the industry desired to continue the orderly marketing of coke, it would seem that whatever the pros and cons of the economics of the carburetted water gas and the coal gas therm might be, it was certain that when schemes for additional gas-making plant were under review, coke demand should have as much consideration as gas demand, particularly when one considered the large number of coke-burning appliances which were being fitted annually.

It was unfortunately only too true that there were cases where available carbonising plant could not be worked at full capacity because the industry's coal allocation was insufficient, and it was no doubt this factor among others which deterred boards from going forward with projects for new carbonising plant. Was it not a fact, however, that there was not really a shortage of coals suitable for carbonisation, but rather that

(*Concluded on p. 729*)

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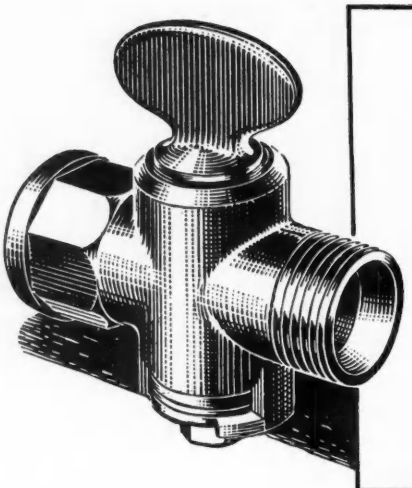

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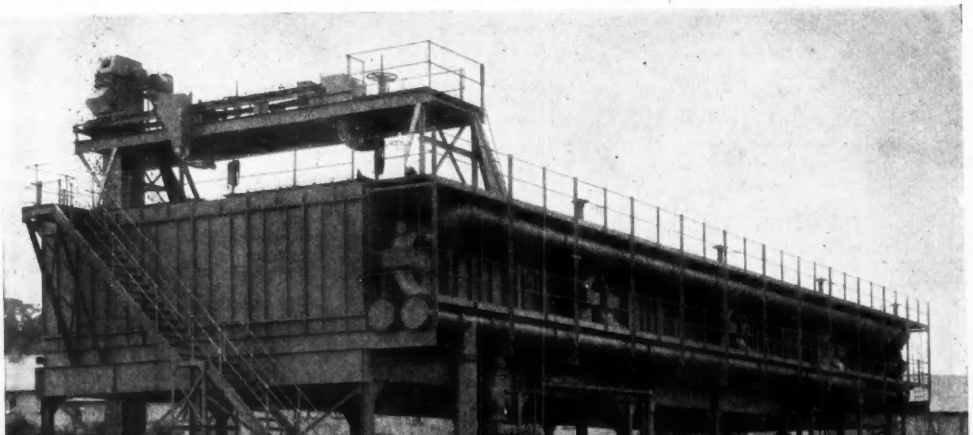

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they were being used in a raw state for other purposes? Given sufficient coal, the industry could provide the coke needed for new appliances.

He would wholeheartedly support the author in his plea that the gas industry should do its very best to meet the growing demands for coke, resulting from the fact that housing authorities were at last following a policy which the industry had been advocating over many years. If, in its wisdom, the industry sat on the fence, then it must not be surprised to find that the Coal Board, through the efforts of the C.U.J.C., would provide the fuel for these appliances to the ultimate complete exclusion of coke; and it might not be long before the marketing of the industry's coke would pass completely into the hands of the Coal Board, who might then well determine the price to be paid for it, much as the gas industry could at one time more or less dictate its own terms to the coke ovens for their surplus gas.

In brief, if the industry wished to retain and develop its market for coke, then it must have regard to its demand at all times and not only when it had surplus coke. He would submit that the industry's prestige, as suppliers of smokeless fuel, suffered a severe setback when consumers, having been educated to install modern coke-burning equipment, found they were unable to obtain supplies of fuel. Clearly the production of gas must have first call on available coke supplies, but the industry's responsibilities towards its many coke consumers could not, and should not, be lost sight of.

Author's Reply

Mr. Evetts in a brief reply said he was interested to hear Colonel Gould stating his figures regarding Crawley, and he congratulated those concerned that they were getting a high figure of 80% at Crawley and 86% on one of the new L.C.C. estates. He was informed that at Oxhey, which was a new L.C.C. estate with about 4,200 houses completed, the percentage was 75. The cost of pre-stressed concrete tanks depended entirely on conditions obtaining locally.

In regard to the fitting of leak clamps on the 18 in. main which was laid some years ago, this was a most expensive item, and, in fact, when it was worked out they felt that it was almost cheaper to re-lay the whole system. In regard to ring mains at Crawley, Colonel Gould set out a case for mains working to 30 in. pressure. Obviously, the cost did come down, but he did not think it could compare with radial mains running from a central point.

G. J. 4358

E. G. Stewart (North Thames Gas Board) chats with G. le B. Diamond (Chairman of the West Midlands Gas Board).

THE BENEVOLENT FUND

MR. J. H. DYDE presided at the general meeting on May 28 of the Contributors to the Benevolent Fund of the Institution, and moved the adoption of the report of the Committee of Management for 1951-52 and accounts for 1951. He said that contributions by way of subscriptions for the years 1949-51 had risen from £1,427 to £1,477—a matter of only £50. Membership of the Institution in 1949 was 2,572, and at the end of December, 1951, it was 3,087, an increase of about 500. Yet the increase in annual subscriptions was only a matter of £50. The percentage of members who contributed had fallen from 53% to 47%.

Mr. W. O. KIRKWOOD (Sunderland) seconded.

Dr. W. T. K. BRAUNHOLTZ, Hon. Secretary, announced that the scrutineers had reported that the two members elected to serve on the Committee of Management for 1952-53 were Mr. A. Tran (Oxford) and Mr. F. Wilson (Darlington).

Mr. J. E. WAKEFORD (Birmingham) in moving a vote of thanks to the Chairman, Committee of Management, and Secretary of the Fund, said it was rather pitiful to think that the amount contributed by subscriptions and donations represented per member of the Institution an average of 2d. per week. He emphasised that if the committee was to carry out satisfactorily its obligations in this connection they must see that a reasonable and regular income was forthcoming. The amount available fell sadly short of what was required. If all non-subscribing members were to covenant for only one halfpenny per day, the annual income of the Fund would be doubled. Dependents of late members would thankfully remember the generous help accorded to them. He suggested to the chairmen of the district sections that each in his own area in his year of office should do his utmost to ensure that every member of the Institution made some contribution.

Mr. A. PICKARD (Llanelly) in seconding said that as members of the Institution they took the benefits which membership gave them. In doing so, they accepted responsibility to meet the obligations which membership carried as well as the benefits received. The Benevolent Fund was one of the greatest of those responsibilities.

There must have been many occasions on which the Committee would have likely to be a little more generous. They might have felt that if subscribers to the Fund knew of the circumstances they would have wished them to be a little more generous. They were doing their part. They had done it well in the past year. It remained for subscribers to see that they got the increased income which would enable them to do the job as fully and adequately as they would wish them to do it.

The CHAIRMAN, acknowleding the vote of thanks, said the reserve fund benefited by a handsome anonymous donation of £1,000 during the year.

INSTITUTION VISITS

(*Concluded from p. 686*)

who participated in this most interesting visit formed a part of the 15,000 visitors who are shown round the factory every year. They saw examples of the most up-to-date gas baking ovens in the world—each with an hourly gas consumption of some 7,000 cu.ft. The prepared wheat passes through the ovens on continuous conveyors, the cooking process, from entering to leaving the oven, taking just one hour. Each oven has an output of 71.5 cases of 36 boxes of 12 portions—equivalent to 30,888 breakfasts per hour.

The visitors also saw the wheat storage silos, cookers and curing tanks, driers, shredding machinery, packing and carton sealing, boiler house, repair shop and central stores.

HERTFORDSHIRE TOUR

ON Friday there was a full-day tour embracing Hemel Hempstead New Town, Harpenden, where luncheon was provided in the Public Hall, and visits in the afternoon to Hatfield House and Luton Hoo for inspection of the historical mansions, art collections, and grounds.

(On earlier pages we describe the Institution visits to the Gothic Works, Edmonton, of Glover & Main, Ltd., and to the Ponders End Works of the Eastern Gas Board.)

Personal

BIRTHDAY HONOURS

The first Honours List of the new reign, published last Thursday on the occasion of the Queen's official birthday, included the following:

ORDER OF THE BATH.—C.B.: **Mr. Ian M. Forsyth,** Under Secretary, Coal Division, Ministry of Fuel and Power.

ORDER OF ST. MICHAEL AND ST. GEORGE.—C.M.G.: **Mr. John H. Brook,** Assistant Secretary, Ministry of Fuel and Power.

ORDER OF THE BRITISH EMPIRE.—C.B.E.: **Mr. James Bowman,** Chairman, Northern (Northumberland and Cumberland) Division, National Coal Board; **Dr. D. T. A. Townend,** Director-General, British Coal Utilisation Research Association. O.B.E.: **Mr. James Carr,** M.B.E., M.C., Area General Manager, South Western Gas Board. M.B.E.: **Mr. T. J. Gale,** Designer, Pulsometer Engineering Co., Ltd., Reading; **Mr. W. Clark Jackson,** Coal Officer, Wales Gas Board; **Mr. D. B. Parkinson,** Area Liaison Officer, Eastern Gas Board (Hon. Secretary, No. 1172 Esher Squadron, Air Training Corps); **Mr. A. T. Phillips,** Chief Draughtsman, North Thames Gas Board; **Mr. P. H. J. Price,** Group Production Engineer, Morecambe, North Western Gas Board; **Mr. F. C. Smith,** Joint Secretary, Watson House Centre, North Thames Gas Board.

BRITISH EMPIRE MEDAL (B.E.M.): **G. E. Barrett,** Valveman, Oxford Gasworks, Southern Gas Board; **J. Hall,** Boiler Stoker, Walsall Division, West Midlands Gas Board; **W. R. H. Lorimer,** Sales and Distribution Superintendent, Alnwick, Northern Gas Board; **J. McGarroch,** lately Shift Foreman, Paisley, Scottish Gas Board; **E. Raistrick,** Fitter, Birkshall Gasworks, Bradford, North Eastern Gas Board; **G. W. Rimron,** Fittings Foreman, Port Talbot, Wales Gas Board; **F. A. Scott,** Staff Foreman, Tar and Ammonia Products Works, Beckton, North Thames Gas Board; and **W. Woodhead,** Storekeeper-Fitter, Elsecar Works, East Midlands Gas Board.

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Mr. James M. Dow, Group Manager, Renfrewshire group, Scottish Gas Board, has been appointed President of the Paisley Rotary Club for the ensuing year. Mr. Dow succeeded Mr. Sydney Smith as Engineer and Manager of the Paisley undertaking in 1946, having previously held a similar appointment with Kirkcaldy Town Council for a period of 10 years. Mr. Dow is a Past-President of the former North British Association of Gas Managers.

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Sir Henry Tizard, G.C.B., A.F.C., F.R.S., has been appointed a part-time member of the North Thames Gas Board. Sir Henry, who is 66, was Permanent Secretary of the Department of Scientific and Industrial Research, and for several years Chief Scientific Adviser to the Government. Educated at Westminster School and Magdalen College, Oxford, he was Lecturer in Natural Science, Oriel College, 1911 to 21, Rector of Imperial College of Science and Technology 1929 to 1942, President of Magdalen College, Oxford, 1941 to 1946, and President of the British Association, 1949. He was Chairman of the Advisory Council on Scientific Policy and Defence Research Policy Committee, and a member of the National Research Development Corporation.

Mr. Arnold Watson, General Manager of Castrol sales for the last four years, has been elected to the Board of C. C. Wakefield & Co., Ltd. He is 43 and joined the firm in 1929. During the war Mr. Watson piloted all types of British and American operational aircraft. He served as Chief Test Pilot, Air Transport Auxiliary, and was awarded the O.B.E.

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Mr. A. W. J. Harris, formerly Deputy Works Engineer at the Nechells works of the Birmingham Division of the West Midlands Gas Board, has been appointed by the East Midlands Gas Board as Group Engineer, Leicester group. **Mr. J. W. Wilson,** Deputy Mains Engineer, Notts. and Derby Division, has been appointed Divisional Distribution Engineer for Lincolnshire division, with effect from July 1.

Obituary

Mr. Arthur Hammond, of Coventry, who has died at the age of 81, started work with the Coventry Gas Company at the age of 13. When the undertaking was acquired by the Corporation in 1884, Mr. Hammond became collector and later manager of the gas showrooms at the Council House. He retired after 52 years' service.

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Mr. Cyrus Broomhead, formerly Managing Director of the Hygienic Stove Co., Ltd., died on May 25, aged 66 years. He had been with the Company since 1903, when he started as a junior clerk. He was later appointed office manager and secretary, and in 1928 was made a Director. For many years before his retirement, a short while ago, he was Managing Director.

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Mr. Frank Ashton, District Manager of the Kirkham undertaking, Fylde group, North Western Gas Board, accompanied by Mrs. Ashton, was involved in a road accident near Carlisle on May 20, and both, severely injured, were taken to the Cumberland Infirmary, Carlisle. Mr. Ashton died on May 27 without regaining consciousness, but Mrs. Ashton is making satisfactory progress. Mr. Ashton was 59 years of age and had spent 43 years in the gas industry. Since vesting date his position as District Manager, Kirkham, followed that of Engineer and Manager of the Kirkham Gas Company, to which he was appointed in 1932, after 23 years at the Middleton Corporation Gas Department. 'R. B.' writes: 'Frank Ashton was held in high esteem throughout the Fylde group and indeed the North Western area. The writer and countless others had affectionate regard for both Mr. and Mrs. Ashton, simple living in their ways, carrying on the daily task, without fuss but with good humour, in a courteous and efficient manner, to a gilt-edged pattern of their own inimitable design. In his contribution to the gas industry he laboured long to a style where the best was always a minimum and his diligence to every facet of a small self-contained gas making undertaking commanded universal admiration and respect.'

Diary

June 13.—London and Southern Juniors: Annual Business Meeting, 178, Edgware Road, 6.30 p.m.

June 16-21.—International Gas Union: Fifth International Gas Conference, Brussels.

June 17.—Notts and Derby Division, Sales and Service Circle: Visit to Ascot Gas Water Heaters, Ltd., Neasden.

June 19.—Wales Juniors: Ladies' Day. Visit to Ascot Gas Water Heaters, Ltd., Neasden.

June 20.—Scottish Juniors (Western): Annual Golf Outing and Competition.

June 21.—Western Juniors: Summer Meeting and Ladies' Day, Ilfracombe.

June 21.—London and Southern Juniors: Summer Visit and Ladies' Day, Maidstone.

June 21.—Manchester Juniors: Ladies' Day, Morecambe and Lancaster.

June 23-25.—British Wood Preserving Association: Second Convention, Queen's College, Cambridge.

June 24.—London and Southern Section, I.G.E.: Summer Meeting.

June 26.—Gas Research Board: Extraordinary General Meeting (winding up), 17, Grosvenor Crescent, S.W., 4 p.m.

June 26.—British Coke Research Association: Fifth Conference, 'Further Studies in Coking Pressure'; principal speakers: W. Idris Jones, T. C. Finlayson, H. E. Blayden, and G. E. Hall; William Beveridge Hall, London University, 2.45 p.m.

STANTON DEVELOPMENTS

OVER 2,700,000 tons of coke have been made in the coke ovens erected by the Woodall Duckham Company and put into production in 1941 at the works of the Stanton Ironworks Co., Ltd., near Nottingham. Progress is now being made with a further scheme, details of which are published in the current number of the *Stantonian*.

In a note on the scheme, the Managing Director states that the installation of a coke oven plant marked an important change in the policy of the Company. Until then all the coke required by the blast furnaces at Stanton was purchased in the open market. The 41 ovens were planned to produce about one-half of the coke used at Stanton, leaving the other half still to be purchased together with all the coke used at the Company's blast furnaces at Holwell and Wellingborough.

The balance of coke oven gas, after using about 40% of the total make of gas for under-firing the coke ovens, is sold to Nottingham, Derby, and Long Eaton.

Ever since the end of the war consideration has been given to the doubling of the coke oven plant. The economics of this proposal depend largely on the use which can be made of the gas, and after full examination of all possible alternatives it was decided to combine the doubling of the coke oven plant with other schemes for improving the efficiency of the blast furnace plants at Stanton.

The most satisfactory method of obtaining maximum gas utilisation at Stanton is to fire the coke ovens with clean blast furnace gas and thereby release the rich coke oven gas for use by the East Midlands Gas Board in its local gas grid.

At present the quantity of coke oven gas available for sale to the East Midlands Gas Board is about 6,500,000 cu. ft. per day. When the new scheme is in full operation the quantity available to the Gas Board will be about 24 mill. cu.ft. per day.

The new scheme, therefore, in addition to the doubling of the coke oven plant, involves large expenditure in connection with both of the blast furnace plants at Stanton and in particular the cleaning of 192 mill. cu.ft. per day of blast furnace gas.

This major scheme, which involves large capital expenditure, was approved in 1951 by the various Ministries and the Iron and Steel Corporation of Great Britain.

News in Brief

At the Invitation of the Wakefield Group, North Eastern Gas Board, two talks were given by Mr. M. H. Thornton, Water Heater Sales Manager, Radiation Group Sales Limited, and Mr. H. W. P. Shewring, Radiation Technical Service, on the practical approach to storage water heating. The talks were well attended and lively discussions took place.

A Home Service Exhibition was held recently by the Fylde group of the North Western Gas Board at Fleetwood, and, in four days, attracted a total attendance of 1,400. Afternoon and evening cookery demonstrations were given to capacity audiences. Visitors included the Mayor and Mayoress of Fleetwood, (Mr. and Mrs. E. A. Lawrence), Mr. Alan Smith (Town Clerk of Fleetwood) and Mrs. Smith.

The Southport Ambulance Cup was recently won by a team from the North Western Gas Board after gaining second place in the St. John Ambulance Brigade North Western district preliminary competition for the Dewar Cup at Preston. The Liverpool team with 255 marks was only four marks behind Broughton, the winners, who will now represent the North West in the final competition for the Dewar Cup in London.

Road Tar Conference

REPRESENTATIVES of the tar producers and distillers of Belgium, England, France, Germany (West), Holland, Italy, Switzerland, and Sweden, met in Paris on April 24 to consider the re-establishment of the International Road Tar Conference. Originally formed in 1931, the Conference had for its object the pooling of the results of research, experiment, and practical experiences of those whose work is connected with the production and application of road tar, and to collaborate with each other through discussions of the most recent technical developments in each country. During the period 1931-39, meetings and plenary sessions of the Conference were held in a number of countries. A wide range of papers by the leading technicians were presented for discussion, and numerous visits were made to tar distilleries, quarries, roads, etc. Unfortunately, the activities of the Conference ceased on the outbreak of war.

After the lapse of years it is gratifying to know that the Conference has now been re-established, the secretariat of which will be situated in Paris for the time being. The activities of the Conference will be controlled by an executive committee consisting of the representatives of the member countries, and it is hoped to arrange for conferences to be held in different countries every two years. The Conference will be of considerable benefit to the members concerned.

Mr. Stanley Robinson, President of the British Road Tar Association, was unanimously invited to be the first President of the re-established Conference, which office he has since accepted. He is also Chairman of the Midland Tar Distillers, Ltd.

AN EXHIBITION FOR 2,000 CATERERS

UNIQUE in that its main industry is catering for the permanent guest and seasonal holiday maker, Bournemouth has some 2,000 hotels and guest houses. What better centre, then, for an exhibition of large-scale gas cooking equipment?

The Western Division of the Southern Gas Board, in collaboration with R. and A. Main, Ltd., staged such an exhibition from May 2 to 24 at the Old Christchurch Road premises of the Bournemouth undertaking.

Hoteliers and caterers were invited through the medium of local Press advertising and by personal contact through the sales department; the show was also publicised by effective window displays.

The layout of the exhibition was arranged and the window displays were set up by the display department of the Bournemouth undertaking. The 'Planned Kitchencraft' unit, first shown at the 1952 Hotel and Catering Exhibition, formed an arresting feature in the main showroom.

A comprehensive selection of 'Main' appliances were exhibited in the lower floor showroom and included a GF 91/R deep fat fryer, DYW 2/62 double oven range, DYWU 2/62 double oven range with unit type hotplates, RF 2/24 gas roasting ovens in vertical battery of two GG 30 gas griller on tall stand, GHC/L60 gas hot closet and carving table, TW/L52 gas boiling table, and GS 182424 gas steamer.

A section of the large-scale gas cooking equipment display at the Bournemouth showrooms.